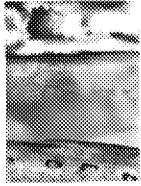


## **Attachments**

WaterLegacy Letter to U.S. Army Corps of Engineers  
June 29, 2017



**Paula Goodman Maccabee, Esq.**

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June 16, 2014

**SENT ELECTRONICALLY**

Ms. Tamara Cameron ([tamara.e.cameron@usace.army.mil](mailto:tamara.e.cameron@usace.army.mil))

Chief, St. Paul District Regulatory Branch

US Army Corps of Engineers

Sibley Square at Mears Park

190 5th Street East, Suite 401

St. Paul, MN 55101-1638

RE: PolyMet Mining Corp. NorthMet Project Clean Water Act Section 404 Permit  
MVP-1999-5528-JKA

Dear Ms. Cameron:

This letter is submitted on behalf of WaterLegacy, a Minnesota non-profit formed to protect Minnesota's water resources and the communities that rely on them. We appreciate that the U.S. Army Corps of Engineers ("USACE") reissued public notice on December 13, 2013 for a Clean Water Act ("CWA") Section 404 permit for the proposed PolyMet NorthMet copper-nickel mining project ("PolyMet Project") in conjunction with the release of the PolyMet Supplemental Draft Environmental Impact Statement ("SDEIS"). Issuance of this notice permitted tens of thousands of Minnesotans to comment on the proposed Section 404 permit to dredge and fill wetlands in the Partridge River and Embarrass River watersheds of the Lake Superior Basin.

WaterLegacy is writing to request that the USACE make a commitment that an additional CWA Section 404 public notice will be issued at such time as PolyMet submits a complete stand-alone application that is not dependent on environmental review documents or at the time that a Final Environmental Impact Statement ("Final EIS") is completed for the Project.

The U.S. Environmental Protection Agency ("EPA"), in its comments on the Section 404 permit, highlighted the interdependence of PolyMet's Section 404 application with the SDEIS analysis. In its March 13, 2014 comments on the Section 404 permit, the EPA noted that PolyMet's Section 404 application references draft environmental review documents to meet requirements for compliance with the CWA §404(b)(1) Guidelines ("Guidelines"). The EPA stated that draft EIS documents "are subject to change based on public and agency comments" and recommended, "that the Corps not issue the CWA §404 permit until the Final EIS is completed or the application is amended to be a standalone document, and compliance with the Guidelines can be determined."

WaterLegacy believes that an updated CWA Section 404 notice to the public will be required when PolyMet's Section 404 application is amended or when the Final EIS is completed. Until that time, information on potential impacts on wetlands and water quality that would result from the PolyMet Project, and on practical alternatives to avoid and mitigate those impacts is still substantially incomplete. Significant gaps in this information were highlighted in the EPA's

Ms. Tamera Cameron (Section 404 Notice PolyMet)  
June 16, 2014  
Page 2

March 13, 2014 comments on the PolyMet SDEIS.

The EPA's March 13, 2014 comments on the PolyMet SDEIS identified areas where information to determine wetlands impacts and mitigation was missing from the SDEIS to which PolyMet's Section 404 application referred, including: 1) quantitative assessment of all indirect impacts on wetlands; 2) description of mitigation for indirect wetlands impacts; and 3) proposals for compensatory mitigation for all losses of wetland functions from fragmentation.

The EPA also identified areas where the PolyMet Final EIS must provide new information to determine impacts on water quality, such as recalibration of modeling to include seepage on the east side of the tailings basin, and evaluation of mercury releases and bioaccumulative risks.

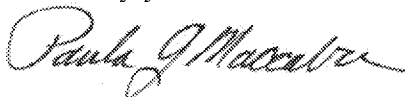
In addition, neither PolyMet's application nor the USACE's December 2013 Section 404 public notice identified the least environmentally damaging practicable alternative for the PolyMet Project. PolyMet's Section 404 application referred back to the SDEIS, which the EPA concluded contained no identification of an LEDPA. EPA comments on the PolyMet SDEIS summarized, "The SDEIS does not identify the least environmentally damaging practicable alternative (LEDPA). This information will be required for CWA Section 404 permitting under CWA Section 404(b)(1)."

Federal CWA regulations require that a Section 404 notice "include sufficient information to give a clear understanding of the nature and magnitude of the activity to generate meaningful comment." 33 C.F.R. §325.3(a). Courts have held that where a Section 404 notice fails to provide substantive mitigation information, "Plaintiffs could not provide meaningful comments, and the public comment process for this permit was fatally flawed." *OVEC v. U.S. Army Corps of Eng'rs*, 674 F. Supp. 2d 783, 804 (S.D. W. Va. 2009); cf. *OVEC v. U.S. Army Corps of Eng'rs*, 76 ERC (BNA) 1973; 43 ELR 20075 (S.D.W. Va. 2013).

No USACE Section 404 notice for the PolyMet Project will be sufficient under CWA regulations until the Final EIS is completed or PolyMet provides a stand-alone Section 404 application answering critical questions about wetlands impacts and mitigation, seepage from waste facilities, mercury releases, and the LEDPA to avoid, minimize and mitigate impacts to wetlands and water quality.

Please feel free to contact me (651-646-8890) if you have questions regarding WaterLegacy's request for additional notice under CWA Section 404 when PolyMet has completed a full stand-alone application or when the Final EIS for the PolyMet Project has been completed. Thank you for your interest in ensuring effective public participation and meaningful comment.

Sincerely yours



Paula Goodman Maccabee  
Advocacy Director/Counsel for WaterLegacy

cc: Tinka Hyde, U.S. Environmental Protection Agency (Hyde.Tinka@epa.gov)  
Kenneth Westlake, U.S. Environmental Protection Agency (Westlake.Kenneth@epa.gov)



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 5  
77 WEST JACKSON BOULEVARD  
CHICAGO, IL 60604-3590

**MAR 13 2014**

REPLY TO THE ATTENTION OF:

**E-19J**

Brenda Halter  
Forest Supervisor  
U.S. Forest Service – Superior National Forest  
8901 Grand Avenue Place  
Duluth, Minnesota 55808

Colonel Dan Koprowski  
Commander  
U.S. Army Corps of Engineers – St. Paul District  
180 5<sup>th</sup> Street East, Suite 700  
St. Paul, Minnesota 55101-1678

Tom Landwehr  
Commissioner  
Minnesota Department of Natural Resources  
500 Lafayette Road  
St. Paul, Minnesota 55155-4040

**Re: Supplemental Draft Environmental Impact Statement for the NorthMet Mining Project and Land Exchange, Hoyt Lakes, St. Louis County, Minnesota – CEQ No. 20130361**

Dear Ms. Halter, Colonel Koprowski, and Mr. Landwehr:

The United States Environmental Protection Agency (EPA) has reviewed the Supplemental Draft Environmental Impact Statement (SDEIS) for the NorthMet Mining Project and Land Exchange. This SDEIS was prepared by Environmental Resources Management (ERM), consultant to the U.S. Army Corps of Engineers (USACE), U.S. Forest Service (USFS), and the Minnesota Department of Natural Resources (MDNR). These agencies are collectively referred to as the “co-lead agencies.” EPA conducted its review pursuant to its authorities and responsibilities under the National Environmental Policy Act (NEPA), Council on Environmental Quality regulations (40 CFR Parts 1500-1508), Section 309 of the Clean Air Act, Section 404 of the Clean Water Act (CWA), and its June 27, 2011 agreement to participate as a cooperating agency.

The proposed project is the first non-ferrous hard rock mine on the Mesabi Iron Range and includes three new surface mine pits, permanent and temporary waste rock stockpiles, an overburden storage and laydown area, a wastewater treatment facility (WWTF), a water collection and conveyance system, a central pumping station (CPS), and a rail transfer hopper. Two processing facilities, one for beneficiation and one for hydrometallurgical processing, would be located on the old LTV Steel Mining Company (LTVSMC) site, and PolyMet (the company) proposes to use and expand the existing LTV tailings basin. The proposed land exchange anticipates that 6,650 acres of Superior National Forest will be exchanged for up to 6,722 acres of privately-owned lands. The proposed project is within land ceded by the Lake Superior Chippewa Tribe to the U.S. by treaty, known as the 1854 Ceded Territory, upon which tribal members exercise reserved rights.

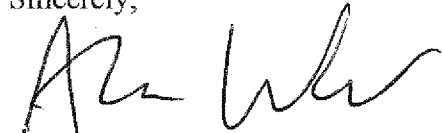
EPA reviewed the Draft Environmental Impact Statement (DEIS) and rated it as “Environmentally Unsatisfactory – Inadequate EIS (EU-3)” on February 18, 2010. EPA also reviewed the Preliminary Supplemental Draft Environmental Impact Statement (PSDEIS), and provided comments to the co-lead agencies on August 7, 2013. We appreciate the extensive improvements to the project and the clarity and completeness of the environmental review that are reflected in the SDEIS. The co-lead agencies have adequately addressed EPA’s comments on the PSDEIS pertaining to well sample analysis methods, stormwater management controls, ground water flow calculations, water quantity impacts to Yelp Creek, wetland mitigation rates and mitigation bank locations, stream monitoring, ground water drawdown, asbestos-like fibers, implementation of an anti-idle policy, EPA’s role as a cooperating agency, public availability of technical documents, material disposal during reclamation, financial assurance, bedrock fractures, wetland permitting, and use of organic amendments (peat). EPA retains oversight authority for permitting of wetland fill, National Pollutant Discharge Elimination System (NPDES) discharges, and water quality and aquatic habitat certification. We will work with USACE and the Minnesota Pollution Control Agency (MPCA) as necessary to address these issues during project permitting.

EPA has engaged in extensive discussions with the co-lead agencies while reviewing the SDEIS. As we recently discussed, there remain a number of areas where potential environmental impacts should be more effectively addressed, and where the project description and evaluation in the SDEIS should be improved. Accordingly, EPA has rated the SDEIS as “Environmental Concerns – Insufficient Information (EC-2).” This rating reflects environmental impacts that are identified in the SDEIS, and that can be avoided or further mitigated as necessary and appropriate. It also reflects the need for further analysis to fully assess and avoid or mitigate environmental impacts. Finally, it addresses areas where the FEIS should be more clearly written to inform decisionmakers and the public. A description of the assigned rating is enclosed.

Attached to this letter are EPA’s detailed comments and recommendations. Most of EPA’s 37 comments recommend changes that will support a complete and easily understandable Final Environmental Impact Statement (FEIS), with an adequate level of detailed analysis to inform decisionmakers and the public. Also included are recommendations to further analyze potential impacts that have been raised by the SDEIS, with an expectation that avoidance or mitigation will be considered as necessary and appropriate.

EPA is committed to continuing to work with the co-lead and cooperating agencies to make sure that all relevant information is made available for public comment in the FEIS, and looks forward to discussing these comments to resolve any questions before issuance of the FEIS. Please contact me at 312-353-8894 or Kenneth Westlake of my staff at 312-886-2910 to schedule this discussion.

Sincerely,

A handwritten signature in black ink, appearing to read 'Alan Walts', written over a horizontal line.

Alan Walts, Director

Office of Enforcement and Compliance Assurance

Enclosures: Summary of Rating Definitions and Follow Up Action  
EPA Detailed Comments

cc: Doug Bruner, U.S. Army Corps of Engineers – St. Paul District (email copy)  
Tamara Cameron, U.S. Army Corps of Engineers – St. Paul District (email copy)  
Erik Carlson, Minnesota Pollution Control Agency (email copy)  
Esteban Chiriboga, Great Lakes Indian Fish and Wildlife Commission (email copy)  
John Coleman, Great Lakes Indian Fish and Wildlife Commission (email copy)  
Steve Colvin, Minnesota Department of Natural Resources (email copy)  
Randall Doneen, Minnesota Department of Natural Resources (email copy)  
Lisa Fay, Minnesota Department of Natural Resources (email copy)  
Ann Foss, Minnesota Pollution Control Agency (email copy)  
Andrew Horton, U.S. Fish and Wildlife Service (email copy)  
Michael Jimenez, U.S. Forest Service – Superior National Forest (email copy)  
Bill Johnson, Minnesota Department of Natural Resources (email copy)  
Tyler Kaspar, 1854 Treaty Authority (email copy)  
Bill Latady, Bois Forte Band of Lake Superior Chippewa (email copy)  
Shannon Lotthammer, Minnesota Pollution Control Agency (email copy)  
Nancy Schuldt, Fond du Lac Band of Lake Superior Chippewa (email copy)  
Margaret Watkins, Grand Portage Band of Lake Superior Chippewa (email copy)  
Darren Vogt, 1854 Treaty Authority (email copy)

**SUMMARY OF RATING DEFINITIONS AND FOLLOW UP ACTION<sup>1</sup>****Environmental Impact of the Action**LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impacts. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

**Adequacy of the Impact Statement**Category 1-Adequate

The EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collecting is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for the EPA to fully assess the environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

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<sup>1</sup> See EPA Manual 1640: *Policy and Procedures for the Review of the Federal Actions Impacting the Environment*.

**INDEX****EPA DETAILED COMMENTS****NORTHMET PROJECT – SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT  
STATEMENT****I. Water Quality****A. Mine Site****B. Plant Site****C. Water Quality Standards****D. National Pollutant Discharge Elimination System****E. Water Modeling****II. Wetlands****III. Cumulative Impacts****IV. Other Topics**

- Financial assurance
- Least Environmentally Damaging Practicable Alternative
- Noise
- Land exchange
- Ground water capture efficiency
- Cultural resources
- Environmental justice
- Wild rice rulemaking
- Geotechnical stability

**EPA DETAILED COMMENTS****NORTHMET PROJECT – SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT****I. Water Quality****A. Mine Site**

*Comment # 1.* Spill prevention is an important part of the mitigation for this project. Using new or retrofit side dump rail cars (possibly with hydraulic air-operation conversions) should be considered as part of the mitigation package for the proposed action. Proactive mitigation through the use of updated rail infrastructure would help reduce spillage and subsequent environmental concerns, possibly including the need for additional long-term water treatment.

**Recommendation:** Consider use of new or retrofit side-dump rail cars when producing the spilled ore plan.

*Comment # 2.* Pages 5-50 forward describe how the company has classified its waste rock and tailings into four categories based on their likelihood to generate acid rock drainage. We understand from discussion with the co-lead agencies that lime will be added to Category 1 waste rock, which is expected to result in neutral to slightly basic pH.

**Recommendation:** The FEIS should indicate that Category 1 waste rock leachate is expected to have a neutral to slightly basic pH due to the addition of lime.

**B. Plant Site**

*Comment # 3.* Page 5-157, Section 5.2.2.3.3, 2<sup>nd</sup> Paragraph: information on the design, operations, and monitoring plans for the hydrometallurgical research facility (HRF) is insufficiently detailed.

**Recommendation:** The FEIS should provide information on the HRF's design and operations in sufficient detail for the reader to understand potential impacts associated with this facility and how those impacts will be avoided or mitigated. This includes explaining that a detailed Residue Management Plan for this facility will be required during permitting.

*Comment # 4.* Page 4-336 discusses the possibility of inundating an existing coal ash landfill located within the proposed tailings basin. Based on current knowledge of leachate concentrations found in groundwater at such landfills, inundation may lead to future water quality impacts.

**Recommendation:** The FEIS should discuss how constituents found in the coal ash landfill may impact water quality in the Embarrass River, how this landfill will be protectively managed, and how any impacts will be mitigated.

### **C. Water Quality Standards**

*Comment # 5.* CWA requirements for antidegradation (“nondegradation” in Minnesota’s terminology) help ensure that a proposed project will not result in a loss of existing uses of surface waters, and preclude reduced water quality unless the State determines it is necessary to accommodate important social and economic development (see 40 CFR 131.12). This review must occur before project activity that may result in a new or increased discharge commences, and should not be deferred until NPDES permitting. EPA understands from discussion with MPCA that much, if not all, of the information needed for an antidegradation review is already contained in the SDEIS.

**Recommendation:** The FEIS should include an evaluation of which of Minnesota’s nondegradation rules (7050.0180, 7050.0185, 7052.0300) apply to this project, and explain how the project complies with the applicable nondegradation rules.

*Comment # 6.* The proposed project provides significant overall environmental improvements over the proposal in the DEIS through installation of seepage containment and other controls at the former LTV tailings basin. However, the SDEIS modeling predicts increases in aluminum (Al) and lead (Pb) in surface waters affected by the proposed project – including exceedances of evaluation criteria for Al and Pb at locations on four tributaries to the Embarrass River (p. 5-7 to 5-8). These predicted increases are based on a number of assumptions, including the contribution from remediation of the former LTV tailings basin. The SDEIS modeling also predicts other increases and exceedances of evaluation criteria based on the “Continuation of Existing Conditions” scenario. EPA understands that monitoring of receiving waters down gradient of the existing tailings basin is being carried out now. This monitoring data will be an important source of information to consider along with modeling results.

**Recommendation:** Available monitoring data should be used to inform NPDES permitting. Monitoring should continue throughout the life of the project to inform permitting, adaptive management, and additional measures to prevent or mitigate impacts to aquatic life as necessary.

### **D. National Pollutant Discharge Elimination System**

*Comment # 7.* The SDEIS anticipates that pollutants will be discharged from mine site features, travel via groundwater pathways and reach the Partridge River several years following the start of the mining project. See SDEIS Table 5.2.2-26. However, as EPA has stated previously, the pollutants originating from mine site features may discharge to jurisdictional wetlands and tributaries prior to reaching the Partridge River. CWA Section 301 prohibits any point source discharge of pollutants to waters of the United States, either directly or via directly connected ground water, unless the discharge complies with a NPDES permit. Waters of the United States include jurisdictional wetlands and tributaries. See 40 CFR 122.2.

**Recommendation:** The FEIS should reflect the fact that a NPDES permit is required before the pollutants from the mine site reach waters of the U.S. (including jurisdictional wetlands and tributaries). Statements in the SDEIS about when discharges will reach waters of the U.S. should be revised, and these changes should be reflected in the FEIS.

#### **E. Water Modeling**

*Comment # 8.* The Tribal Cooperating Agencies Cumulative Effects Analysis (September 2013) included in Appendix C of the SDEIS states: “PSDEIS Table 4.2.2-18 reports Colby Lake as currently having an observed mean for Arsenic of 0.78 to 1.4 ug/L (depending on the data set), whereas Figure 5.2.2-35, the No- Action (continuation of current conditions)” P50 model for Colby Lake Arsenic shows annual maximum values of 0.5 ug/L.” In addition, the SDEIS shows Colby Lake’s current mean arsenic concentration as 0.78-1.4 ug/L on Table 4.2.2-18, with a range of 0.25 – 2.3 ug/L, while the modeled p90 maximum value in Figure 5.2.2-35 lists the maximum concentration of arsenic in Colby Lake as 0.70 ug/L. Comparing the modeled mean for arsenic in Colby Lake to existing site-specific data in the SDEIS, the model outputs underestimate arsenic concentrations by up to 100%. Colby Lake is currently modeled as a continuation of the Partridge River because there is insufficient data to model it as a lake, which may be causing this discrepancy. We understand that monitoring is ongoing, which may provide additional information on observed arsenic concentrations.

**Recommendation:** The FEIS should document an analysis that addresses this discrepancy between existing conditions in Colby Lake and modeling results, taking into account all necessary data. The FEIS should include any follow-up actions that will be necessary based on this analysis.

*Comment # 9.* Modeling using MODFLOW assumes no seepage through the berm on the east side of the tailings basin. The co-lead agencies have agreed to reexamine this assumption. MODFLOW outputs are used as an input to the GoldSim model, so changes to these outputs may require updated GoldSim modeling as well.

**Recommendation:** Recalibrate MODFLOW as necessary to reflect seepage on the east side of the tailings basin, and update GoldSim modeling as necessary. The FEIS should explain how this comment was addressed.

*Comment # 10.* Modeling of water quality parameters is subject to inherent uncertainties that call for ongoing evaluation. For example, acid rock drainage (ARD) in cold, wet climates raises uncertainty due to climatic factors including distinct freeze-thaw cycles, varying contributions from rain and snow, and a period of significant melting during the spring thaw.

**Recommendation:** The permit to mine should require water quality modeling throughout the life of the mine, assuring that the model uses input from actual monitoring discharge data as it becomes available, so this information can be used to support adaptive management. The model should accommodate specific climatic factors associated with the site.

*Comment # 11.* MDNR has collected new Partridge River flow data that vary from the base flow calculations used for modeling in the SDEIS. The co-lead agencies have explained that the

model accounts for this discrepancy, which is correlated with pit dewatering from the upstream Peter Mitchell Pit, a factor that was not present during the time period used for continuous flow data in the SDEIS (1978-1987). Details are provided in a technical memorandum from the co-lead agencies.<sup>2</sup>

While the flow data used in the SDEIS was appropriate, low-flow conditions may not represent the most conservative conditions, though they are conservative in that they assume less dilution of contaminants. However, dilution is the only variable considered. High-flow conditions, while increasing dilution, may mobilize contaminants to a greater extent than expected under low-flow conditions.

**Recommendation:** The FEIS should evaluate how base flow affects variables other than dilution, taking into account high-flow as well as low-flow scenarios.

*Comment # 12.* There is insufficient detail to explain why “outlier” data were excluded from consideration in the GoldSim model.

**Recommendation:** The FEIS should provide a specific justification to support excluding any such data from modeling.

*Comment # 13.* Page 5-61: the SDEIS shows that tailings leachate pH increases after 300 weeks, but does not show how leachate pH was extrapolated to the longer term, such as 50-100 years. We understand this data is already available.

**Recommendation:** The FEIS should show how leachate pH was extrapolated to the longer term, such as 50-100 years, through a graph or chart.

*Comment # 14.* The SDEIS could be interpreted to imply that the plant site is expected to need water treatment for up to 500 years, and the mine site for up to 200 years. We understand from discussion with the co-lead agencies that this interpretation is incorrect.

**Recommendation:** The FEIS should clearly explain the timeframe during which water treatment is projected, for both the plant and mine sites.

*Comment # 15.* Page 5-20: the SDEIS states that “mercury was not included in the GoldSim model, as insufficient data and a general lack of definitive understanding of mercury dynamics prevented modeling mercury like the other solutes.” It also states that “regardless, the NorthMet Project Proposed Action would still need to demonstrate consistency with the mercury evaluation criteria (see Section 5.2.2.1).” Given the absence of modeling data for mercury, it is unclear how consistency with mercury evaluation criteria will be determined.

**Recommendation:** The FEIS should either provide a supporting rationale that explains why elemental mercury does not warrant modeling, and how consistency with mercury

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<sup>2</sup> See: *Baseflow Estimates Used in the NorthMet Mining Project SDEIS*, dated March 5, 2014.

evaluation criteria will be determined; or include modeling and evaluation of elemental mercury. If GoldSim is not suitable to model this pollutant, elemental mercury can be modeled using a different water quality model, such as the Water Quality Analysis Simulation Program (WASP)<sup>3</sup>, which is commonly used by EPA to model elemental mercury.

*Comment # 16.* Page 5-509, Section 5.2.10.2.6, 5<sup>th</sup> paragraph: The SDEIS states that “increased mercury concentrations, and associated increases in mercury bioaccumulation in fish tissue could therefore constitute an environmental justice impact for Band members and other subsistence consumers of fish;” and that “deposition of mercury from the NorthMet Project Proposed Action would cease at closure, but mercury bioaccumulation in fish tissue and existing fish consumption limits could persist beyond the mine’s operational life.” Table 5.2.2-51 shows how much elemental mercury is expected to leave the project site under currently-proposed control measures. Further consideration of mercury impacts is needed.

**Recommendation:** The FEIS should refine the quoted statement to more clearly characterize the risks associated with mercury releases. Based on this risk characterization, the FEIS should explain what has been and will be done to avoid, minimize, and mitigate mercury releases from the project.

## II. Wetlands

*Comment # 17.* The SDEIS describes current site conditions, including the acreage, type, and quality of the wetland resources at the tailings basin and mine sites. The SDEIS also describes the proposed direct impacts remaining after measures to avoid or minimize direct impacts. However, the SDEIS does not quantitatively assess indirect impacts or measures to minimize and mitigate these impacts, except with respect to wetland losses due to fragmentation. The SDEIS also omits all indirect impacts from the cumulative impacts analysis for wetlands (Section 6.2.3.4).

**Recommendation:** The FEIS should quantitatively assess all indirect impacts. The FEIS should more clearly describe the proposed mitigation plan, including mitigation for indirect impacts. The monitoring and mitigation plans in the CWA Section 404 permit should clearly explain proposed measures to minimize and mitigate indirect wetland impacts during the project.

**Recommendation:** The FEIS should include indirect impacts in the analysis of cumulative impacts to wetlands.

*Comment # 18.* The SDEIS uses wetland assessment sites as an approach for evaluating impacts. The location of these assessment sites is discussed in the SDEIS, and Figure 4.2.3-2 shows locations of wetland assessment sites as points in a diagram. There are few wetland assessment

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<sup>3</sup> See: <http://www.epa.gov/athens/wwqtsc/html/wasp.html> for more information on the WASP Model.

site locations north and south of the mine site, and those shown on Figure 4.2.3-2 are far from the site boundary. The SDEIS does not sufficiently explain the assessment approach.

**Recommendation:** The FEIS should describe in more detail the wetland assessment protocol and the assessment sites used, including the assessment methods used at those locations, why these locations were chosen, and how will they be used (e.g., for monitoring future wetland conditions).

*Comment # 19.* Section 5.2.3 states that 26.9 acres will be impacted by fragmentation, and that these losses will be mitigated. The criteria used to determine fragmentation are broadly described in Section 5.2.3.1.2, but lack sufficient detail.

**Recommendation:** The FEIS should describe in more detail the criteria used to determine fragmentation losses.

*Comment # 20.* Figure 5.2.3-4 highlights wetland areas at the mine site where the proposed mine features would indirectly impact wetlands by fragmentation. Fragmentation is defined in the SDEIS as causing a change in the watershed area by greater than 20%. The SDEIS (Page 5-226) briefly describes how fragmented wetlands were identified, but does not explain the method for determining the 20% threshold. Indirect impacts from fragmentation at the mine site will also include habitat fragmentation, divisions in vegetative communities, and the general loss of functions in wetlands that are divided from adjacent wetlands and made smaller by mine features. Wetland areas that are surrounded on all sides by mine features will be fragmented because their ecological functions will be impaired.

**Recommendation:** The FEIS should explain how the 20% threshold was determined. The FEIS should also recognize that the term “fragmentation” may define indirect impacts other than changes in watershed size. These other factors should be included when estimating fragmentation impacts. Compensatory mitigation should also be proposed for all losses of wetland functions due to wetland fragmentation (in addition to adverse impacts from changes to a wetland’s watershed).

*Comment # 21.* Section 5.2.3 describes the proposed wetland mitigation plan. EPA previously commented on the proposed mitigation ratios, and supports the mitigation ratios proposed in USACE’s May 29, 2013 Draft Memorandum on *The Application of the Federal Mitigation Rule and St. Paul District Policy Guidance on Compensatory Mitigation*, as described on page 5-316. The SDEIS describes the proposed ratios, but also states, “The determination of final mitigation credits ...would be determined during permitting” (p 5-224).

**Recommendation:** The FEIS should provide a status update on development of final wetland mitigation credits. EPA will work with USACE during CWA Section 404 permitting to determine the final wetland mitigation credits needed, including mitigation for indirect impacts.

*Comment # 22.* The proposed mitigation plan includes post-mining on-site wetland mitigation. Restoration of wetlands on the site as part of reclamation is positive and important, but EPA and

USACE have agreed that mitigation credits are not appropriate given how long it will be before this mitigation is carried out. The SDEIS contains inconsistent statements regarding whether or not on-site mitigation is proposed to generate mitigation credits.

**Recommendation:** The FEIS should be clear that post-mining, on-site mitigation will not be used for mitigation credits. The mitigation plan in the CWA Section 404 permit should exclude mitigation credits for post-mining, on-site wetland mitigation.

*Comment # 23.* Page 6-36, Table 6.2-8 and Pages 6-40 to 6-42, Table 6.2-11: There appear to be some inconsistencies between Table 6.2-8 and Table 6.2-11 with respect to reported future wetland and water resource numbers, including the bullet summaries for the Partridge River (Page 6-40) and Embarrass River (Page 6-42). For the Partridge River, Table 6.2-11 and bullet summary text note future condition with 3,516 acres of deepwater resources, while Table 6.2-8 indicates 1,922 acres.

**Recommendation:** The FEIS should resolve or explain these inconsistencies.

### **III. Cumulative Impacts**

*Comment # 24.* Page 6-21, Section 6.2.3.3.2: the “Contributing Past, Present, and Reasonably Foreseeable Actions” section, lists twelve foreseeable future actions with potential cumulative effects on surface water hydrology and quality in the Partridge River and Embarrass River watersheds. There is some inconsistency between this list and Table 6.2-1 (Page 6-7). “Cliffs Erie, LLC – Hoyt Lakes Area (former LTVSMC),” and “Cliffs Erie, LLC – Area 5 NW Pit” are not included in the table, at least not by these names.

**Recommendation:** The FEIS should resolve or explain these inconsistencies, and use consistent names for foreseeable future actions to simplify cross-referencing by the reader.

*Comment # 25.* Page 6-26 states: “In summary, the maximum cumulative effects of the NorthMet Project Proposed Action, plus present and reasonably foreseeable future actions on the hydrology of the Partridge River, would be expected to reduce average annual flow in the Lower Partridge River at any time during operations by no more than 8.4 cubic feet per second (cfs) and 2.4 cfs (2 percent) during closure of the NorthMet Project Proposed Action, based on average annual flow of 112 cfs at USGS gauging station 04016000 downstream of Colby Lake.” In some cases, this effect is well above the mean recorded flow of the Upper Partridge River during certain times of the year. The SDEIS does not address how flow reductions will affect the Partridge River and its resources.

**Recommendation:** The FEIS should include a total or net effect calculation for each table in the water resources section, similar to that provided for the wetlands analysis in Table 6.2-8, (Page 6-36) which shows total and incremental cumulative effects. The FEIS should add a row for the total or net effect to Table 6.2-2.

**Recommendation:** The FEIS should discuss the magnitude and significance of these flow reductions, including additional analysis or information as necessary. Potential impacts caused by these reductions should be discussed in section 6.2.3.3.3.

*Comment # 26.* Pages 6-22 to 6-25 and 6-27 to 6-28, Section 6.2.3.3.3: This text does not reference sources of hydrological effects data for each action.

**Recommendation:** The FEIS should reference sources of hydrological effects data for each action.

*Comment # 27.* Table 6.2-15 shows the direct effect of other actions in terms of populations of each plant species affected. However, the SDEIS notes that for 4 out of 9 potentially contributing actions, "The NHIS data and MDNR take permit data were reviewed and no vegetation records were available for these actions. As a result, these actions are not considered in the cumulative effects analysis for vegetation."

**Recommendation:** The FEIS should indicate whether the lack of vegetation records indicate no cumulative effects on vegetation, or simply lack of data on the subject.

#### **IV. Other Topics**

##### Financial Assurance

*Comment # 28.* We understand that MDNR will not calculate detailed financial assurance until the Permit to Mine process, although it may have additional information before the FEIS is issued.

**Recommendation:** The FEIS should include additional information on financial assurance as available.

##### Least Environmentally Damaging Practicable Alternative

*Comment # 29.* The SDEIS does not identify the least environmentally damaging practicable alternative (LEDPA). This information will be required for CWA Section 404 permitting under CWA Section 404(b)(1).

**Recommendation:** The FEIS should describe the process that will be used to determine the LEDPA, and should provide LEDPA information to the extent it is available.

##### Noise

*Comment # 30.* The Noise section and page 5-370 of the SDEIS does not sufficiently describe potential noise impacts from blasting and vibrations on wildlife. A cited Federal Highway Administration technical document in Appendix C of the SDEIS provides information on the sound threshold and frequency range for four biologic classes (mammals, birds, reptiles, and amphibians).

**Recommendation:** The FEIS should contain analyses of noise and vibration impacts to wildlife based on the above biologic classes' sound threshold and frequency range, based on information included and cited in the SDEIS. Any impacts and/or mitigation measures should be noted in the FEIS.<sup>4</sup>

#### Land Exchange

*Comment # 31.* On pages 1-14 and 1-15, the SDEIS notes that the USFS must determine that "the public interest will be well served" before it can enter into a discretionary, voluntary real estate transfer (36 CFR 254.3(b)). This analysis is included in the SDEIS, but should be made clearer and more focused.

**Recommendation:** The FEIS should clearly and concisely summarize the analysis of the proposed land exchange (Alternative A) and Alternative B under 36 CFR 254.3(b), including a clear explanation of the rationale and criteria for selecting the preferred land exchange alternative, and of how protecting cultural resources is included in the public interest determination.

#### Ground Water Capture Efficiency

*Comment # 32.* The SDEIS states that modeled groundwater capture system efficiency at the tailings basin is at least 90%. However, it does not explain the basis for this estimate.

**Recommendation:** The FEIS should provide the specific model assumptions that were used to make this determination.

**Recommendation:** The FEIS should indicate that any discharge not captured by the proposed capture systems and entering waters of the U.S. (e.g., jurisdictional wetlands, the Partridge and Embarrass Rivers and their tributaries) is subject to NPDES permitting.

#### Cultural Resources

*Comment # 33.* Pages 4-261 through 4-264 refer to cultural resources/Section 106 resources solely as historic properties.

**Recommendation:** The FEIS should make it clear that cultural resources include archaeological resources.

*Comment # 34.* Moose is a culturally-important species that has traditionally been subsistence hunted by the Chippewa Tribe. The SDEIS does not adequately describe how the proposed project will impact moose population and habitat of moose. Based on information in the SDEIS, it appears that there are unconsidered impacts to moose population and habitat, such as the proposed impacts to two local wildlife corridors, moose reliance on wetlands during warm weather, and impacts on foraging.

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<sup>4</sup> *Synthesis of Noise Effects on Wildlife Populations*, USDOT Publication No. FHWA-HEP-06-016, September 2004. <[http://www.fhwa.dot.gov/environment/noise/noise\\_effect\\_on\\_wildlife/effects/effects.pdf](http://www.fhwa.dot.gov/environment/noise/noise_effect_on_wildlife/effects/effects.pdf)>

**Recommendation:** The FEIS should more completely explain how the proposed action will impact moose population and habitat.

#### Environmental Justice

EPA's environmental justice comments are included in Comment # 16.

#### Wild Rice Rulemaking

*Comment # 35.* On March 13, 2014, MPCA released preliminary findings on the effects of sulfate on wild rice growth.

**Recommendation:** The FEIS should provide the most current available information on MPCA's findings, and on next steps based on these findings.

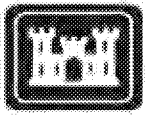
#### Geotechnical Stability

*Comment # 36.* Section 5.2.14 addresses geotechnical issues at the mine. Reasonable stability analyses were conducted for the permanent waste rock pile, but it is unclear if the company has committed to designing this unit so it meets conservative static stability Factors of Safety (FOS) (static FOS of 1.5 and seismic FOS >1). The company has committed to meeting conservative FOS for both the tailings basin and the HRF.

**Recommendation:** The FEIS should clarify the company's commitment with respect to design of the permanent waste rock pile.

*Comment # 37.* Liquefaction analyses were not conducted for the HRF, based on the assumption that those wastes could compress and that the likelihood of liquefaction is remote. However, liquefaction and liner leakage could occur at the HRF because the HRF is proposed to be located above a hydraulically-active seep, which will place inward hydraulic pressure on the HRF liners.

**Recommendation:** The potential for liquefaction should be analyzed. The FEIS should clearly summarize the results of this analysis, including next steps in response to this analysis.



US Army Corps  
of Engineers  
St. Paul District

**APPLICANT: PolyMet Mining, Inc.**

## **Public Notice**

**ISSUED: 13 NOV 2015**

**EXPIRES: 14 DEC 2015**

**REFER TO: MVP-1999-05528-JKA**

**SECTION: 404 - Clean Water Act**

### **NOTICE OF AVAILABILITY OF FINAL ENVIRONMENTAL IMPACT STATEMENT AND SUPPLEMENTAL NOTICE FOR SECTION 404 PERMIT APPLICATION**

**PURPOSE** - The purpose of this public notice (PN) is twofold: first, provide notice to the public that the Final Environmental Impact Statement (FEIS) for the proposed NorthMet Mine is available for public review. Second, solicit comments on requested changes to wetland impacts and wetland mitigation that have been proposed since the U.S. Army Corps of Engineers, (Corps) St. Paul District's December 13, 2013, PN describing the proposed project.

1. A JOINT FEDERAL/STATE FINAL ENVIRONMENTAL IMPACT STATEMENT has been prepared by the Corps; the U.S. Forest Service, Superior National Forest (USFS); and the Minnesota Department of Natural Resources (MDNR) that describes the anticipated environmental and socioeconomic impacts of the proposed PolyMet Mining, Inc. (PolyMet) NorthMet Project and Land Exchange. PolyMet submitted a permit application to discharge dredged and fill material into waters of the United States, including wetlands, in conjunction with the development and operation of a proposed open pit mine, ore processing plant, and tailings basin. Additionally, a land exchange is proposed to eliminate a conflict between PolyMet's desire to surface mine and the United States' surface rights, including USFS administration of National Forest System (NFS) land. Low-grade disseminated sulfide-bearing ore would be mined and hauled approximately 8 miles on an existing railroad line to an idle taconite processing facility (the former LTV Steel Mining Company plant), which would be refurbished to process the ore. The ore would be crushed, ground, and concentrated to produce finished copper metal and various copper, nickel, cobalt and precious metals concentrates and precipitates. Tailings would be discharged into an existing taconite tailings basin. The proposed project is located near the cities of Hoyt Lakes and Babbitt in St. Louis County, Minnesota. This action is in accordance with Title 33 Code of Federal Regulations Section 325.2(a)(4), which discusses National Environmental Policy Act procedures and documentation.

Public review copies of the FEIS are available at the following locations: the DNR/MPCA Library, 520 Lafayette Road, St. Paul; the DNR Regional Office at 1201 East Highway 2, Grand Rapids; the DNR Division of Lands and Minerals Regional Office at 1525 Third Avenue East, Hibbing; the Hoyt Lakes Public Library at 206 Kennedy Memorial Drive, Hoyt Lakes; the Babbitt Public Library at 71 South Drive, Babbitt; the Duluth Public Library, 520 West Superior Street, Duluth; and the Minneapolis Public Library, 300 Nicollet Mall, Minneapolis.

The FEIS is also posted on the MDNR website at:

<http://www.dnr.state.mn.us/input/environmentalreview/polymet/index.html>

While the Corps is not soliciting comments on the FEIS during the 30 day review period, any substantive issues raised after the release of the FEIS that have not been addressed in the FEIS will be considered in our Record of Decision (ROD).

2. AN APPLICATION FOR A DEPARTMENT OF THE ARMY PERMIT was submitted to the Corps on August 19, 2013. This application requested authorization to discharge fill material into wetlands adjacent to the Partridge and Embarrass rivers to facilitate the construction and operation of an open pit copper-nickel mine; a railroad connection corridor to transport ore from the proposed NorthMet mine site to the existing LTV Steel Mining Corporation (LTVSMC) plant site; the plant site which includes the processing facilities area, the tailings basin, and the hydrometallurgical facility; Dunka Road and utility corridor; and Colby Lake water pipeline corridor. A public notice was issued on December 13, 2013, describing this proposal; comments were received; and a public hearing was held to give the public an opportunity to further consider this permit application.

The applicant has submitted a request to modify the August 19, 2013, application to include the discharge of fill material into an additional 1.37 acres of wetland. The requested change is described in more detail in paragraph 4 below.

#### SPECIFIC INFORMATION.

APPLICANT'S ADDRESS: PolyMet Mining, Inc.  
P.O. Box 475  
Hoyt Lakes, MN 55750

AGENT: Barr Engineering Company  
4700 West 77<sup>th</sup> Street  
Minneapolis, MN 55435-4803

PROJECT LOCATION: The overall project is located in Sections 5 and 6, Township 58 North, Range 14 West; Sections 1, 2, 3, 4, 9, 10, 11, 12, 15, 16, 17, and 18, Township 59 North, Range 13 West; Sections 3, 4, 5, 8, 9, 10, 13, 14, 15, 16, 17, 20, 23, 24, 29, and 32, Township 59 North, Range 14 West; and Sections 32, 33, and 34, Township 60 North, Range 14 West, near Babbitt and Hoyt Lakes in St. Louis County, MN.

3. BACKGROUND: The initial application was received and a public notice (PN) for the proposed NorthMet mine was issued on May 10, 2005. PolyMet submitted and updated application describing changes to the NorthMet proposal, which was publicly noticed on December 13, 2013. In response to comments received on the public notices, Draft EIS, and the Supplemental Draft Environmental Impact Statement (SDEIS), the EIS was revised to include changes to projected wetland impacts. These changes are included in the FEIS, and wetland impacts requiring a Department of the Army permit are summarized in this PN. This PN provides the opportunity to comment on the 1.37 acres of additional direct wetland impacts since the December 13, 2013 PN.

**DESCRIPTION OF PROJECT:** The applicant proposes to excavate and process a polymetallic ore deposit known as the NorthMet deposit. Open pit mining and waste rock disposal would occur at the mine site area, and ore processing (beneficiation) and tailings disposal would occur at the plant site, which is the currently inactive Cliffs Erie taconite processing facility and adjoining tailings basin.

An Adaptive Water Management Plan (AWMP) is also an integral component of the project. The purpose of the AWMP is to describe a system for implementing adaptive engineering controls that would ensure compliance with applicable water quality standards, and document performance standards for these engineering controls. The AWMP would also ensure the mechanical water treatment system is in place and operational to treat water until such a time that a non-mechanical water treatment system can be proven and built for long term site water management.

The project would develop open mine pits (up to 528 acres), stockpiles (up to 740 acres), and supporting infrastructure (up to 451 acres). Mine site environmental controls would include, among other features, liners and containment systems to collect seepage from stockpiles, a cover to limit infiltration through the permanent stockpile after closure, and a wastewater treatment facility (WWTF) to treat water that comes in contact with mining features. Water collected from pit dewatering and stockpile seepage would be treated, and then pumped to the plant site for use in ore processing. During operations, there would be no direct discharge of treated waste water from the mine site to waters of the U.S. or Minnesota public waters.

The plant site is a “brownfield” location which occupies approximately 4,417 acres. At the plant site the project would upgrade existing facilities (Beneficiation Plant, Tailings Basin, Area 1 Shop, Sanitary Treatment Plant, rail connections, access roads) and construct new facilities (Hydrometallurgical Plant, Hydrometallurgical Residue Facility (HRF), Concentrate Dewatering/Storage Building, and plant site wastewater treatment plant (WWTP)) on previously disturbed areas. The Flotation Tailings would be stored atop the existing LTVSMC Tailings Basin by staged construction of new dams.

Plant site environmental controls during mining operations would include: cover systems to limit infiltration of oxygen and water through the Tailings Basin dams and seepage capture systems to collect seepage from the Tailings Basin. During reclamation and long-term closure these environmental controls would continue to operate, and additional cover systems would be added to the flotation tailings basin (FTB) beaches and pond bottom. Most water used in processing would be recycled from the FTB Pond for use. A plant site WWTP would be constructed to treat any water that cannot be recycled prior to discharge to the environment.

**VEGETATION IN AFFECTED AREA:** Vegetation communities in much of the project area have been altered by previous mining and logging activities. In addition beaver activities have led to the transition of some forested wetlands to open, emergent marshes and wet meadows. Aside from areas disturbed from mining and logging activities, the project vicinity is currently a mosaic of upland and wetland native vegetation community types, which is typical of northeastern Minnesota.

While the mine site is located in an area that has not been directly disturbed by previous mining activities, extensive logging has occurred throughout the area. The USFS owns the surface rights at the mine site, and has managed the area for timber production. The USFS is separately evaluating a land

exchange proposal under which title to surface lands at the mine site would be exchanged for other land within the Superior National Forest. Logging activities have changed the vegetative character across the mine site, with shrub-lands and/or early and mid-successional forest replacing mature upland forest. These logged areas are currently in varying stages of regeneration and consist mostly of young aspen stands. Aside from logging and associated roads, the mine site is largely undeveloped, with a variety of natural vegetation communities present. These communities include coniferous and deciduous forests in the uplands and wetlands such as shrub swamps, marshes, forested swamps, and bogs in the lowlands. The more mature upland forested areas at the mine site are dominated by quaking aspen, jack pine, balsam fir, black spruce, and white spruce with lesser amounts of paper birch, red pine, and white pine.

The plant site was previously used as a taconite processing facility by LTVSMC and is largely devoid of natural vegetation. In addition, the road and railroad corridors are existing infrastructure and therefore previously disturbed areas.

Vegetation surveys were conducted across the project area using the MDNR and USFS Ecological Classification System (ECS). These vegetation surveys identified seven ECS vegetation communities across the project area: fire dependent, forested rich peatland, acid peatland, mesic hardwood, marsh, wet forest, and wet meadow. The uplands at the mine site are dominated by fire dependent forested communities, while the wetlands are dominated by acid peatlands (bogs).

**SOURCE OF FILL MATERIAL:** Local commercial sources and/or on-site material.

**SURROUNDING LAND USE:** The proposed mine site is currently undeveloped land in the Superior National Forest. The site is a mixture of wetlands and uplands. The mine site is approximately 3,015 acres. The mine site has been primarily used for logging and mineral exploration. It is likely that some recreational use (hunting, fishing, etc.) has also occurred on the site. The headwaters of the Partridge River circle the mine site on the north, east, and south. The Dunka Road, a mining road constructed by Erie Mining Company, and a mining railroad line run from southwest to northeast just south of the proposed mine site. The Peter Mitchell open pit taconite mine operated by Northshore Mining Company is located about two miles north of the proposed mine site. Wetlands and forested lands lie to the immediate east, west and south of the proposed mine site. The existing Cliffs Erie mine /stockpile/ plant/ tailings basin complex (where the PolyMet processing facility and tailings disposal would be located) is about eight miles west of the proposed mine site.

4. **WETLAND IMPACTS:** Direct wetland impacts would increase by 1.37 acres over that described in the December 13, 2013, PN. As a result of this additional 1.37 acres of wetland impact, the discharge of dredged or fill material into wetlands would increase from an estimated 912.5 acres to 913.8 acres of wetlands.

The 1.37 acres of direct wetland impacts would occur in conjunction with the construction of the tailings basin containment system that manages tailings basin seepage. These additional wetland impacts would result in the loss of approximately an additional 0.7 acre deep marsh and 0.7 acre of hardwood swamp. These engineering controls have been incorporated to improve the quality of surface/groundwater. The new direct wetland impacts are labeled 1225, 1126, T13 and T13A on the attached figure labeled 4 of 4.

Wetland impacts caused by fragmentation remain unchanged at about 26.9 acres. Methods for impacts to fragmented wetlands were estimated considering the following criteria: change in the size of remaining wetland, wetland type, source of hydrology, direction of flow in the area, location in the current watershed, location in the future watershed, and connectivity to other wetlands.

#### TOTAL WETLAND IMPACTS BY ACRE AND TYPE

WETLAND TYPE	DIRECT & FRAGMENTED	FRAGMENTATION IMPACTS. <sup>1</sup>
Fresh (Wet) Meadow (Type 2 wetland)	15.8	0
Sedge Meadow (Type 2 wetland)	23.9	0.3
Shallow Marsh (Type 3 wetland)	77.0	0.3
Deep Marsh (Type 4 wetland)	74.3	0.2
Shrub Carr (Type 6 wetland)	3.9	50 SQ. FT.
Alder Thicket (Type 6 wetland)	110.6	3.5
Hardwood Swamp (Type 7 wetland)	13.2	0
Coniferous Swamp (Type 7 wetland)	84.4	1.9
Open Bog (Type 8 wetland)	7.6	0
Coniferous Bog (Type 8 wetland)	<u>530.0</u>	<u>20.7</u>
	940.7	26.9

#### 5. WETLAND MITIGATION

**AVOIDANCE AND MINIMIZATION:** PolyMet proposes to avoid and minimize wetland effects by optimizing the placement of mining features such as the mine pits, waste rock and overburden stockpiles, haul roads, water management systems, and supporting infrastructure. Additionally, the processing plant and the transportation and utility corridor would be located on land previously used for industrial purposes. This reuse would avoid the need to disturb additional lands (including wetlands) and would further reduce environmental effects. Avoidance and minimization techniques implemented since May 2005 have reduced direct wetland impacts by 316.3 acres from 1257 acres to 940.7.

**COMPENSATION:** Wetland compensatory mitigation proposed by PolyMet predominately consists of wetland restoration credits generated at compensation sites located: 1) off-site, within the same watershed as the project site (St. Louis River/Great Lakes Basin); and 2) off-site, outside of the St. Louis River/Great Lakes Basin. PolyMet proposes to fully compensate for the direct wetland impacts and potential indirect fragmentation impacts, which total 940.7 acres, by generating approximately 1,562.6 wetland mitigation credits at three off-site wetland mitigation sites, known as the Zim, Hinckley, and Aitkin sites. A description of the mitigation sites is provided in the table below. PolyMet plans to complete initial phases of restoration at the proposed off-site wetland mitigation sites at least one full growing season prior to the occurrence of the wetland impacts for which the mitigation would compensate. Based on additional review and refinement of the mitigation site plans, there has been a decrease of 51.7 acres of estimated mitigation credits that would be available from the three proposed mitigation sites.

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<sup>1</sup> Note Due to rounding error acreage numbers are approximate

## Description of Proposed Compensatory Wetland Mitigation

Mitigation Site	Watershed Name, Bank Service Area (BSA)	County	Township (T), Range (R), Section (S)	Mitigation Method and Estimated Credits
Zim (off-site, within watershed)	St. Louis River #3, BSA #1	St. Louis	T55, R18, S2,3,10,11,26,27, and 34	Restoration/ Preservation 453.9 Credits
Hinckley (off- site, outside watershed)	SNAKE RIVER #36, BSA #6	Pine	T39, R22, S5	Restoration 304.6 Credits
Aitkin (off-site, outside watershed)	Elk-Nokasippi #10, BSA #5	Aitkin	T47, R27, S1; T47, R26, S6	Restoration 804.1 Credits

6. **REPLIES/COMMENTS:** Interested parties are invited to submit to this office written facts, arguments, or objections to the described changes within 30 days of the date of this notice. Comments received may be forwarded to the applicant. The Corps will not edit comments to remove any identifying or contact information, and cautions against submitting any information that should not be publicly disclosed.

Replies may be addressed to the Regulatory Branch, St. Paul District, Corps of Engineers, 180 Fifth Street East, Suite 700, Saint Paul, MN 55101-1678 or by email at [polymet\\_pn\\_comments@usace.army.mil](mailto:polymet_pn_comments@usace.army.mil)

Or, IF YOU HAVE QUESTIONS ABOUT THE PROJECT, call Douglas Bruner at the St. Paul office of the Corps, telephone number (651) 290-5378 or Ralph Augustin, telephone number (651) 290-5329.

To receive Public Notices by e-mail, go to: [http://mvp-extstp/list\\_server/](http://mvp-extstp/list_server/) and add your information in the New Registration Box.

7. **FEDERALLY-LISTED THREATENED OR ENDANGERED WILDLIFE OR PLANTS OR THEIR CRITICAL HABITAT:** The Corps and the U.S. Forest Service have prepared a biological assessment (BA) for the proposed NorthMet mine and land exchange. The assessment included impacts to the following threatened or endangered species: the Canada lynx, the grey wolf, and the northern long-eared bat. The BA has been forwarded to the Fish and Wildlife Service and we are awaiting the results of their Biological Opinion.

8. **JURISDICTION:** These new wetland impacts are being reviewed in accordance with current practices for documenting Corps jurisdiction under Section 404 of the Clean Water Act.

We have made a preliminary determination that the aquatic resources that would be impacted by the proposed project changes are subject to Corps' jurisdiction under Section 404 of the Clean Water Act.

The Corps will prepare an approved or preliminary jurisdictional determination prior to making a permit decision. Approved jurisdictional determinations are posted on the St. Paul District web page at the following link: <http://www.mvp.usace.army.mil/Missions/Regulatory.aspx>.

9. **STATE OF MINNESOTA SECTION 401 WATER QUALITY CERTIFICATION:** Valid Section 404 permits cannot be issued for any activity unless state water quality certification for the activity is granted or waived pursuant to Section 401 of the Clean Water Act. The state Section 401 authority in Minnesota is the Minnesota Pollution Control Agency (MPCA). It is the permit applicant's responsibility to request Section 401 certification from the MPCA, ensure that the MPCA has received a valid, complete application for state Section 401 certification, and to obtain a final Section 401 action from the MPCA.

The MPCA has indicated that it plans to issue its public notice of the Section 401 water quality certification action under Minnesota Rules Part 7001 at a later date. The MPCA has also indicated that the Section 401 process shall commence upon the receipt of a request for Section 401 certification from the permit applicant.

10. **HISTORICAL/ARCHAEOLOGICAL:** The Corps has reviewed information on known cultural resources and/or historic properties within and adjacent to the project area. The Corps in conjunction with the USFS has consulted with Indian Tribes that have historically lived in the area, and directed field and record surveys to identify properties eligible for listing in the National Register of Historic Places. These efforts have been completed and eligible properties have been identified. Effects to historic properties are addressed in the FEIS.

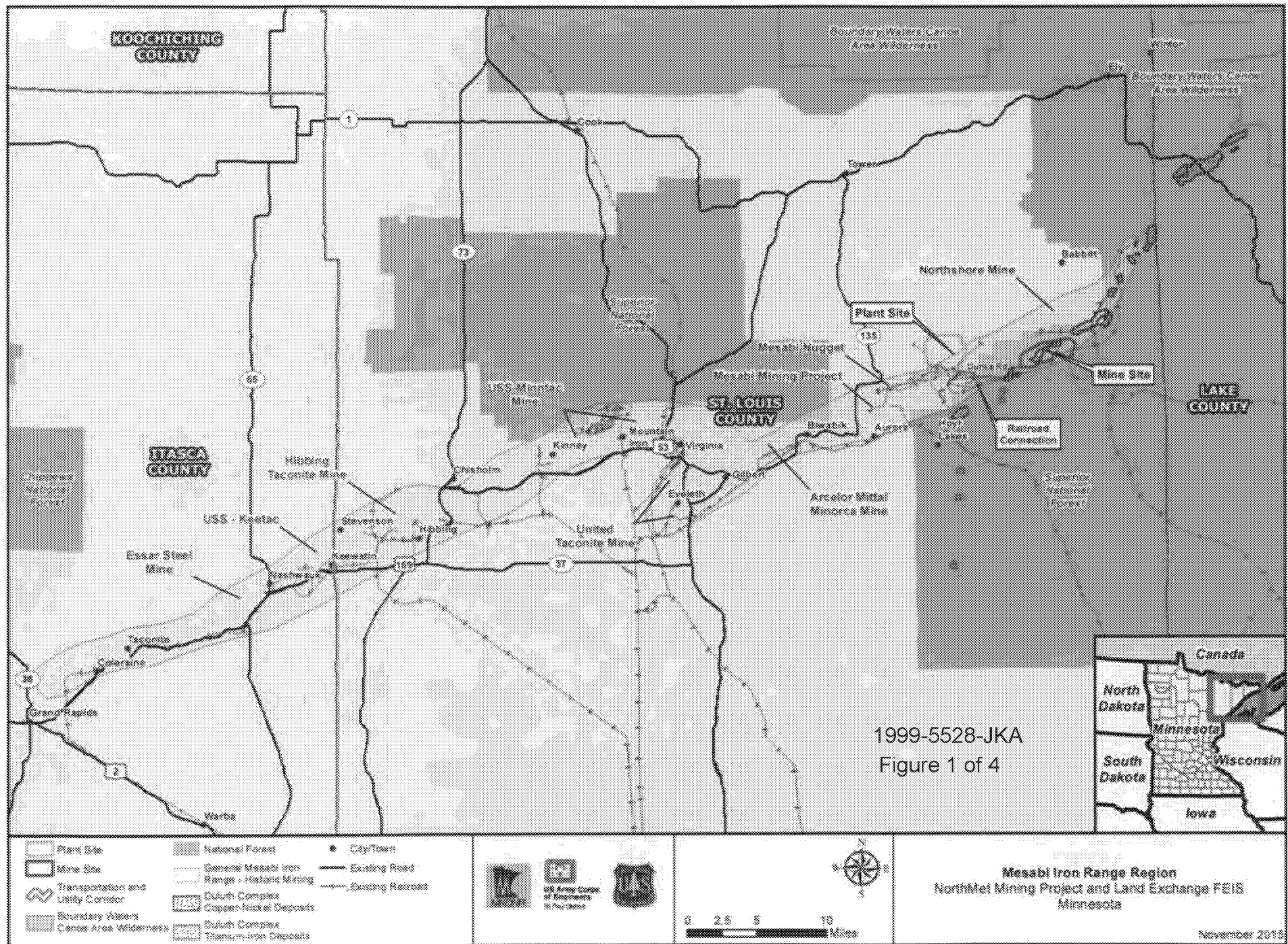
11. **PUBLIC HEARING REQUESTS:** Any person may request, in writing, a public hearing within the comment period specified in this notice that a public hearing be held to consider the additional proposed wetland impacts. Requests for a public hearing shall state, in detail, the reason for holding a public hearing. A request may be denied if substantive reasons for holding a hearing are not provided or if there is no other valid reason served.

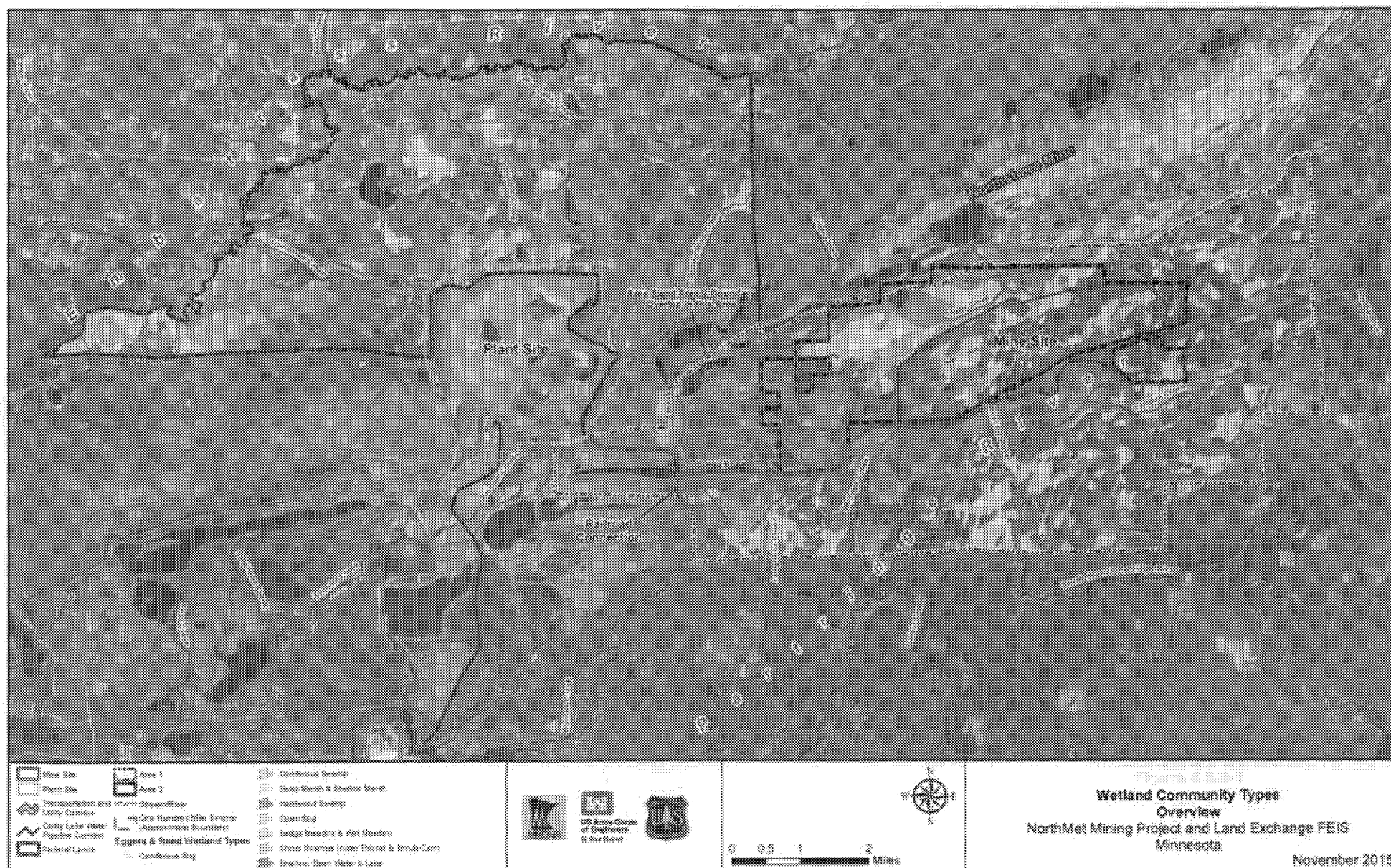
12. **PUBLIC INTEREST REVIEW:** The decision whether to issue a permit will be based on an evaluation of the probable impact, including cumulative impacts, of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered, including the cumulative effects. Among those are conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production and, in general, the needs and welfare of the people.

The Corps is soliciting comments from the public; Federal, State, and local agencies and officials; Indian tribes; and other interested parties in order to consider and evaluate the impacts of the described increase in wetland impacts and changes to proposed wetland mitigation that have occurred since the December 13, 2013, Public Notice. Any comments received will be considered by the Corps to determine whether to issue, condition, or deny a permit for this proposal.

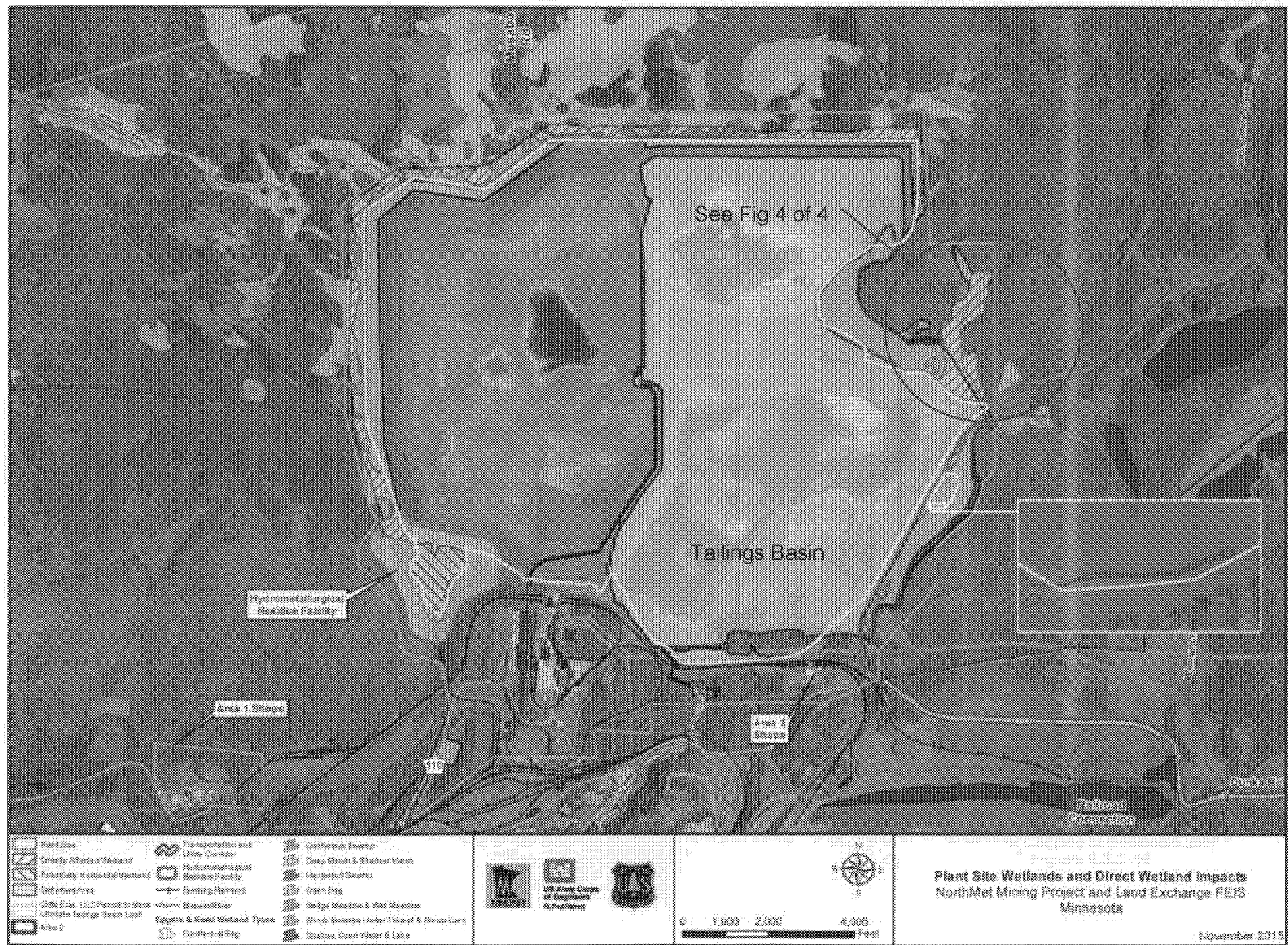
Tamara E. Cameron  
Chief, Regulatory Branch

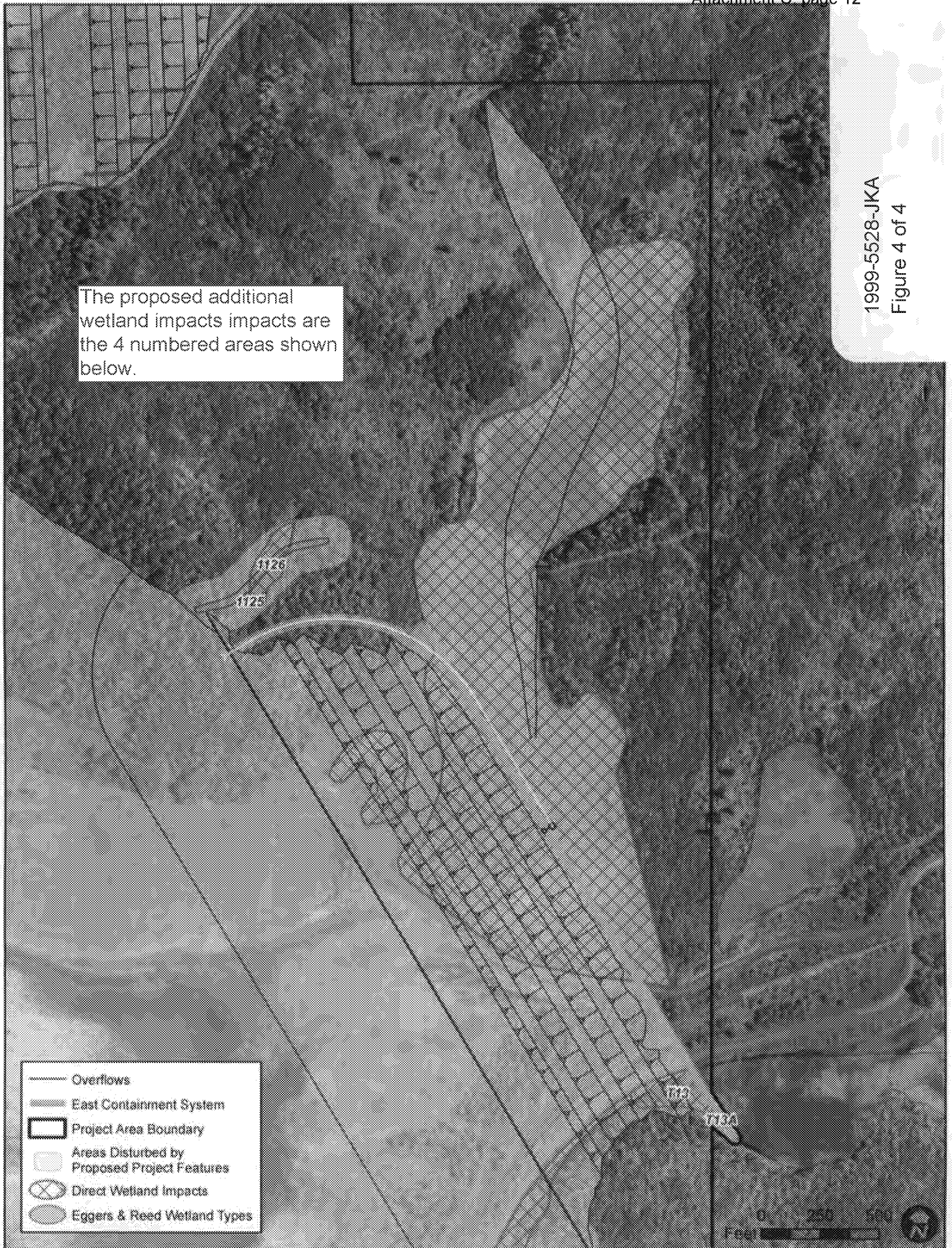
Enclosures





1999-5528-JKA  
Figure 2 of 4

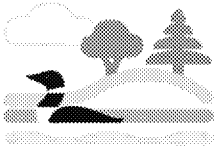




The proposed additional wetland impacts are the 4 numbered areas shown below.

1999-5528-JKA  
Figure 4 of 4

**Minnesota  
Environmental  
Partnership**



**SENT ELECTRONICALLY**

November 19, 2015

Ms. Tamara Cameron  
Chief, St. Paul District Regulatory Branch  
US Army Corps of Engineers  
Sibley Square at Mears Park  
190 5th Street East, Suite 401  
St. Paul, MN 55101-1638  
tamara.e.cameron@usace.army.mil

RE: PolyMet Mining Corp. NorthMet Project Clean Water Act Section 404 Permit  
MVP-1999-5528-JKA  
Request for Public Hearing

Dear Ms. Cameron:

This letter is submitted on behalf of the following environmental and civic organizations: Center for Biological Diversity, Friends of the Boundary Waters Wilderness, Friends of the Cloquet Valley State Forest, Izaak Walton League - Minnesota Division, Minnesota Center for Environmental Advocacy, Northeastern Minnesotans for Wilderness, Protect Our Manoomin, Save Lake Superior Association, Save Our Sky Blue Waters, Sierra Club North Star Chapter, Voyageurs National Park Association, Wilderness Watch, and WaterLegacy.

We appreciate that the U.S. Army Corps of Engineers ("Corps") issued a supplemental public notice on November 13, 2015 for the Clean Water Act ("CWA") Section 404 permit for the proposed PolyMet NorthMet copper-nickel mining project ("PolyMet Project"). Pursuant to this supplemental public notice, and prior to expiration of the comment period on December 14, 2015, the undersigned groups are requesting in writing that a public hearing be held to consider substantive issues pertaining to the additional wetlands impacts and new information pertinent to the Section 404 permit that was not available when public hearings were held on the Project in 2014.

This public hearing is requested pursuant to Section 404(a) of the Clean Water Act and 33 C.F.R. §320.2(f) and § 327.4 to assist the Secretary of the Army, acting through the Chief of Engineers, in determining whether discharge and disposal requested by PolyMet pursuant to Section 404 should be denied, prohibited or restricted to prevent unacceptable adverse impacts on wetlands and downstream water quality.

The Corps' supplemental public notice for the PolyMet Project states, "The 1.37 acres of direct wetland impacts would occur in conjunction with the construction of the tailings basin containment system that manages tailings basin seepage." The undersigned groups request a public hearing to consider issues related to the construction of this tailings basin containment system. These would include issues related to secondary wetlands and water quality impacts of the containment system and impacts of the containment system on dam failure, in light of the Mount Polley tailings breach and the subsequent independent report analyzing its failure, both of which occurred subsequent to the 2014 public hearings on the PolyMet Section 404 permit.

We note that the containment system for which this wetland fill is needed is a new component of the mine plan designed to prevent water quality impacts to the east of the tailings basin, and that the containment system will result in significant changes to the hydrology of the area. The public was unable to comment on the efficacy or impacts of the containment system at the public hearing or during the public comment period on the SDEIS because the system was not part of the plan at that time. Furthermore, the SDEIS misinformed the public in stating that the project had no potential for water quality impacts to the east of the tailings basin, an area where surface waters are already listed as impaired. We note that the risk of water quality impacts in this area was previously undisclosed, and the public has thus not had an opportunity to comment on it.

The undersigned groups further request a public hearing on the PolyMet Section 404 permit on the grounds that PolyMet's August 2013 permit application referenced draft environmental review documents to meet requirements for compliance with the CWA Section 404 Guidelines. As the U.S. Environmental Protection Agency (EPA) noted in its March 13, 2014 comments on PolyMet's 2013 application, since the permit application was not a standalone document and since the 2013 supplemental draft environmental impact statement (SDEIS) was subject to change, receipt of comments addressing the application's compliance with Section 404 requirements could not be limited to the comment period for PolyMet's 2013 application.

The EPA also noted in its March 13, 2014 comments on the PolyMet SDEIS that neither PolyMet's 2013 permit application nor the SDEIS on which the public commented in 2014 public hearings provided any of the following for the PolyMet Project: a quantitative assessment of its indirect impacts on wetlands, a proposal for compensatory mitigation for such secondary impacts, or an identification of the least environmentally damaging practicable alternative (LEDPA) for the Project. In addition, the SDEIS and the original permit application did not contain adequate information on plans for compensatory mitigation to allow for meaningful public review and comment. We understand that the FEIS contains new information on the compensatory mitigation sites and the monitoring plan for indirect impacts. All of this information is required for Section 404 permitting, and a public hearing that would allow comment on the current state of the record on these issues would assist the Corps in its assessment of whether the PolyMet Section 404 permit should be granted, denied, prohibited or restricted.

The undersigned organizations believe that the change in wetlands impacts, the change in the tailings basin collection system, new information regarding secondary effects of the tailings basin collection system on wetlands and dam failure risks, and the gaps and deficiencies in PolyMet's 2013 Section 404 application related to secondary wetlands impacts, compensatory mitigation, and LEDPA provide substantial reasons for a public hearing, the opportunity for which is required by the Clean Water Act.

We would request that such a public hearing be held in January 2016 following a 30-day notice as required by 33 C.F.R. § 327.11(a), and that the Corps' extend the time period within which comments on the PolyMet final environmental impact statement and the Section 404 public notice will be accepted for consideration in the Corps' Record of Decision until at least ten days beyond the hearing date, pursuant to 33 C.F.R. § 327.8(g).

Please inform us at your earliest convenience of the Corps response to our requests. You can contact our groups regarding our request for a public hearing and an extension of the time within which public comments will be accepted by email addressed to [pmaccabee@justchangelaw.com](mailto:pmaccabee@justchangelaw.com) and [aaron@friends-bwca.org](mailto:aaron@friends-bwca.org). Thank you for your interest in ensuring effective public participation and public hearings in this matter.

Sincerely yours,



Steve Morse, Executive Director  
Minnesota Environmental Partnership

Center for Biological Diversity

Friends of the Boundary Waters Wilderness

Friends of the Cloquet Valley State Forest

Izaak Walton League - Minnesota Division

Minnesota Center for Environmental Advocacy

Northeastern Minnesotans for Wilderness

Protect Our Manoomin\*

Save Lake Superior Association

Save Our Sky Blue Waters

Sierra Club North Star Chapter

Voyageurs National Park Association

WaterLegacy

Wilderness Watch\*

\* Not an MEP member organization

**Subject:** Public Hearing (UNCLASSIFIED)

**Date:** Friday, December 18, 2015 at 7:12:16 AM Central Standard Time

**From:** Bruner, Douglas W MVP

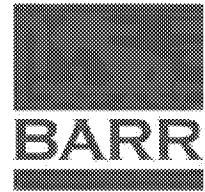
**To:** Paula Maccabee

CLASSIFICATION: UNCLASSIFIED

Ms. Maccabee, I am writing in response to your voice message to Tamara Cameron asking whether we are planning to hold a public hearing in conjunction with our Clean Water Act Section 404 permit evaluation for the proposed Polymet project. We did have a public hearing for the purposes of the Clean Water Act Section 404 permit evaluation process on January 16, 2014. At this time, we have not made a determination regarding another public hearing. We have not completed our review of the responses to our public notice of November 13 inviting comments on changes to wetland impacts associated with the proposed project. We will make a decision regarding the need to hold another public hearing once we have assessed the issues raised by the comments.

Sincerely,

Doug Bruner  
Program Manager for Mining  
U.S. Army Corps of Engineers  
St. Paul District  
651-290-5378  
CLASSIFICATION: UNCLASSIFIED

resourceful. naturally.  
engineering and environmental consultants

## Technical Memorandum

**To:** Jason Boyle, Minnesota Department of Natural Resources (MDNR)  
**Prepared for:** Poly Met Mining, Inc.  
**From:** Tom Radue, P.E.  
**Subject:** Tailings Basin Cell 2E North Dam – Modified Buttress as Alternative to Cement Deep Soil Mix Zone  
**Date:** December 30, 2016  
**c:** Jennifer Saran (PolyMet)

The NorthMet Dam Safety Permit Application, Flotation Tailings Basin (Reference (1)) presents the proposed tailings basin development plan, including development of the North Dam of tailings basin Cell 2E. To achieve desired slope stability factors of safety the Cell 2E North Dam includes placement of a toe-of-slope buttress, and within the interior of the basin, construction of a cement deep soil mix (CDSM) zone. The CDSM zone was added after completion of the original buttress design as a means to add another increment to the slope stability factor of safety.

Since submittal of the Dam Safety Permit Application, Barr has further reviewed the potential for use of a modified buttress as an alternative to the CDSM zone (hereafter referred to as CDSM). This review was motivated by:

- Discussions with DNR's third party geotechnical consultants who have reviewed the Permit Applications
- The simplicity of the buttress construction when compared to the relative complexity of the CDSM.
- Pre-construction planning showing the added construction sequencing flexibility associated with buttress vs CDSM; the buttress can be constructed incrementally over an extended period of time, whereas the CDSM must be fully completed prior to placing the basin into service. This extended period of construction also reduces potential air quality impacts. .
- Evaluation of potential water quality impacts:
  - the mass of rock utilized for a modified buttress would remain within the confines of the Flotation Tailings Basin Seepage Containment System
  - added rock mass would remain a small fraction of the combined mass of flotation tailings and previously planned rock buttress that will be placed at the basin
  - the mass of the modified buttress would remain below the mass utilized in water quality impacts modeling

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- The small and limited extent of additional impacts on wetlands that would occur from buttress modification.

The following sections of this memorandum provide a comparison of the current Cell 2E North Dam buttress/CDSM proposal relative to a buttress (modified) only approach.

### **Cell 2E North Dam Geometry Modifications and Slope Stability**

Figures 1 through 3 show the Cell 2E North Dam buttress in plan and cross-section:

- as proposed in the Dam Safety Permit Application
- with a modified buttress as an alternative to the CDSM

For the modified buttress, the northern toe of the buttress shifts northward a maximum of 107 feet. To accommodate this shift, the seepage containment system alignment also shifts northward, between Stations 176+50 and 208+00 and between Stations 218+80 to 240+00. For the western portion of the buttress, the top elevation increases to 1574 from the previous 1538, and for the eastern portion of the buttress, the top elevation increases to 1559 from the previous 1538. A transition zone connects these western and eastern buttress sections. With the modified buttress, exterior slope would vary between 3H:1V and 3.5H:1V, as compared to the 3H:1V buttress slope; in some areas the buttress slope would become flatter than currently proposed.

Slope stability factor of safety (FOS) computations for the Cell 2E North Dam with buttress and CDSM are presented in the Geotechnical Data Package – Volume 1 – Version 7 (Reference (2)) portion of the Dam Safety Permit Application – Flotation Tailings Basin – Version 1 (Reference (1)). The FOS for  $USSA_{liq}$  conditions controlled the dam design; slope geometry and CDSM configuration was selected to achieve a  $FOS \geq 1.10$  for  $USSA_{liq}$  conditions. All other FOS values ( $ESSA$  and  $USSA_{yield}$ ) are well above the minimums required. The Cell 2E North Dam with modified buttress and absent the CDSM was therefore configured to also achieve a  $FOS \geq 1.10$  for  $USSA_{liq}$  conditions. The resulting slope stability model outputs are provided in the attachment to this memorandum, with the outcomes summarized in Table 1.

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**Table 1 Cell 2E North Dam Slope Stability FOS with Modified North Buttress**

<b>Figure No.</b>	<b>Slope Section Modeled</b>	<b>Slope Condition Modeled</b>	<b>Required Slope Stability Factor of Safety (FOS)</b>	<b>Slope Stability Factor of Safety (FOS) Model Outcome</b>	<b>Slope Stability FOS Equal to or Greater Than Required FOS Yes/No</b>
4	Section F	Lift 8 with Modified Buttress – USSA <sub>liq</sub> , Seepage Containment System Inactive	FOS $\geq$ 1.10	FOS = 1.11	Yes
5	Section F	Lift 8 with Modified Buttress – USSA <sub>liq</sub> , Seepage Containment System Active	FOS $\geq$ 1.10	FOS = 1.12	Yes
6	Section G	Lift 8 with Modified Buttress – USSA <sub>liq</sub> , Seepage Containment System Inactive	FOS $\geq$ 1.10	FOS = 1.10	Yes
7	Section G	Lift 8 with Modified Buttress – USSA <sub>liq</sub> , Seepage Containment System Active	FOS $\geq$ 1.10	FOS = 1.10	Yes

### Construction Material Quantity and Source

The modified buttress requires 3,230,000 cubic yards of fill; an increase of 2,170,000 cubic yards relative to the 1,060,000 for the current buttress proposal. Construction material quantities and placement sequencing is presented in Table 2. Construction material for the buttress, whether as designed or modified, is planned to be obtained from the rock stockpiles at Area 5.

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**Table 2 Flotation Tailings Basin Cell 2E North Buttress Development**

<b>Mine Year (end of)</b>	<b>Approximate Total Quantity In Place (CY) – Proposed Buttress</b>	<b>Approximate Total Quantity In Place (CY) – Modified Buttress</b>	<b>Cumulative Quantity Difference (CY) Modified Buttress – Proposed Buttress</b>
0	0	0	0
1	0	0	0
2	1,060,000	1,060,000	0
3	1,060,000	1,494,000	434,000
4	1,060,000	1,928,000	868,000
5	1,060,000	2,362,000	1,302,000
6	1,060,000	2,796,000	1,736,000
7	1,060,000	3,230,000	2,170,000
<b>Totals</b>	<b>1,060,000</b>	<b>3,230,000</b>	<b>2,170,000</b>

### Air Quality

Air dispersion modeling completed in support of the environmental review process and updated for the NorthMet Air Permit Application included Tailings Basin construction traffic as an emission source. Specifically, Class II modeling (Reference (3)) included fugitive dust generated from material handling and vehicle traffic on unpaved roads, and the Class I modeling (Reference (4)) included the tailpipe emissions from the construction equipment. The air emission risk analysis (AERA) included both fugitive dust and tailpipe emissions from Tailings Basin construction activities (Reference (5)).

A revised version of the Tailings Basin construction movement schedule was developed to accommodate the proposed modified buttress design. The maximum traffic rates, material handling rates and maximum number of trucks were recalculated. The movement schedule used for the previous analyses has 1,355,000 cubic yards of buttress rock moved in Mine Year 3. The maximum quantity moved in a single year (Mine Year 2) is lower under the modified buttress design (1,060,000 cubic yards per Table 2).

The Tailings Basin construction movement schedule assumes that rock for buttress construction comes from Area 5. The road segments included in the haul route from Area 5 to the north side of Cell 2E are A5B and TBI (Figure 8). Under the revised movement schedule, the maximum trips per hour for A5B and TBI is 32, while under the movement schedule for the previous buttress design the maximum number of trips for both roads is 40. VMT is directly proportional to the number of trips per hour ( $VMT = \text{trips/hour} * \text{hours/day} * \text{road length} * 2 \text{ trips/round trip}$ ), so the previously modeled emission rates can accommodate

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the modified buttress construction schedule. In other words, the emissions under a modified buttress design do not exceed the previously modeled emission rates.

Buttress construction requires truck loading at the rock source (Area 5 – AREA5 on Figure 8) and unloading at the construction site (near North Dam of Cell 2E – 2EN on Figure 8). Under the proposed revised buttress design movement schedule, the maximum material handling rate at Area 5 goes down from 2398 tons/hour to 1918 tons/hour and the maximum handling rate at the North Dam of Cell 2E goes down from 4194 to 3176.

The maximum total number of trucks required over the 20-year NorthMet mine life was also recalculated under the modified buttress design with results of 29 trucks, which is lower than the 31 trucks assumed for the Class I and AERA modeling.

Based on the above calculations, the modified buttress design would not result in fugitive dust or construction equipment tailpipe emissions greater than those modeled in previous evaluations. Therefore, modeled impact to air quality would not increase above the values reported in support of the environmental review process or provided with the NorthMet Air Permit Application.

## **Water Quality**

The water quality modeling (GoldSim model) that was conducted to support the Final Environmental Impact Statement (FEIS) (Reference (6)) and permitting considers both the buttress and the CDSM. The buttress is assumed to add to the load of dissolved constituents collected by the seepage containment system with minimal effect on the quantity of water collected.

The Plant Site GoldSim model conservatively assumed a total volume for the north buttress of 3,437,700 cubic yards. Modeling documentation presented in the NorthMet Project Water Management Plan – Plant (Reference (7)) acknowledged that this was a larger volume of material than was planned, but that the actual volume would change as a result of final design. The modified buttress design volume presented in this memo (3,230,000 cubic yards per Table 2) is within the volume of buttress assumed in the GoldSim model (3,437,700 cubic yards). Because mass of the proposed modified buttress design is within the mass of buttress in the GoldSim model, the proposed change presented in this memorandum should not affect analysis of water quality nor the characterization of impacts conducted to support the FEIS or permitting.

## **Wetlands**

The wetlands that are located between the toe of the Flotation Tailings Basin and the outer limit of seepage containment system construction activity were considered to be directly impacted as part of the wetland impacts analysis for the FEIS. Within these areas, the planned buttress would directly impact 29.17 acres of wetland. A modified buttress would directly impact 32.14 acres of wetlands; an increase of 2.97

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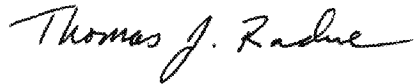
acres over the current proposal. Figure 9 provides a comparison of the wetland area impacts for the proposed buttress and for a modified buttress alternative. The NorthMet Project Wetland Permit Application (Reference (8)) includes the mitigation proposed for the 29.17 acre wetland impact. Additional mitigation would be required for the 2.97 acre increase in wetland impact. These wetlands include deep marsh, coniferous swamp, and shallow marshes, and mitigation requirements would be dependent on the acreage of each type of wetland impacted. This additional mitigation will be accounted for under the appropriate regulatory processes (i.e., USACE, MDNR/WCA).

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### Certification

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

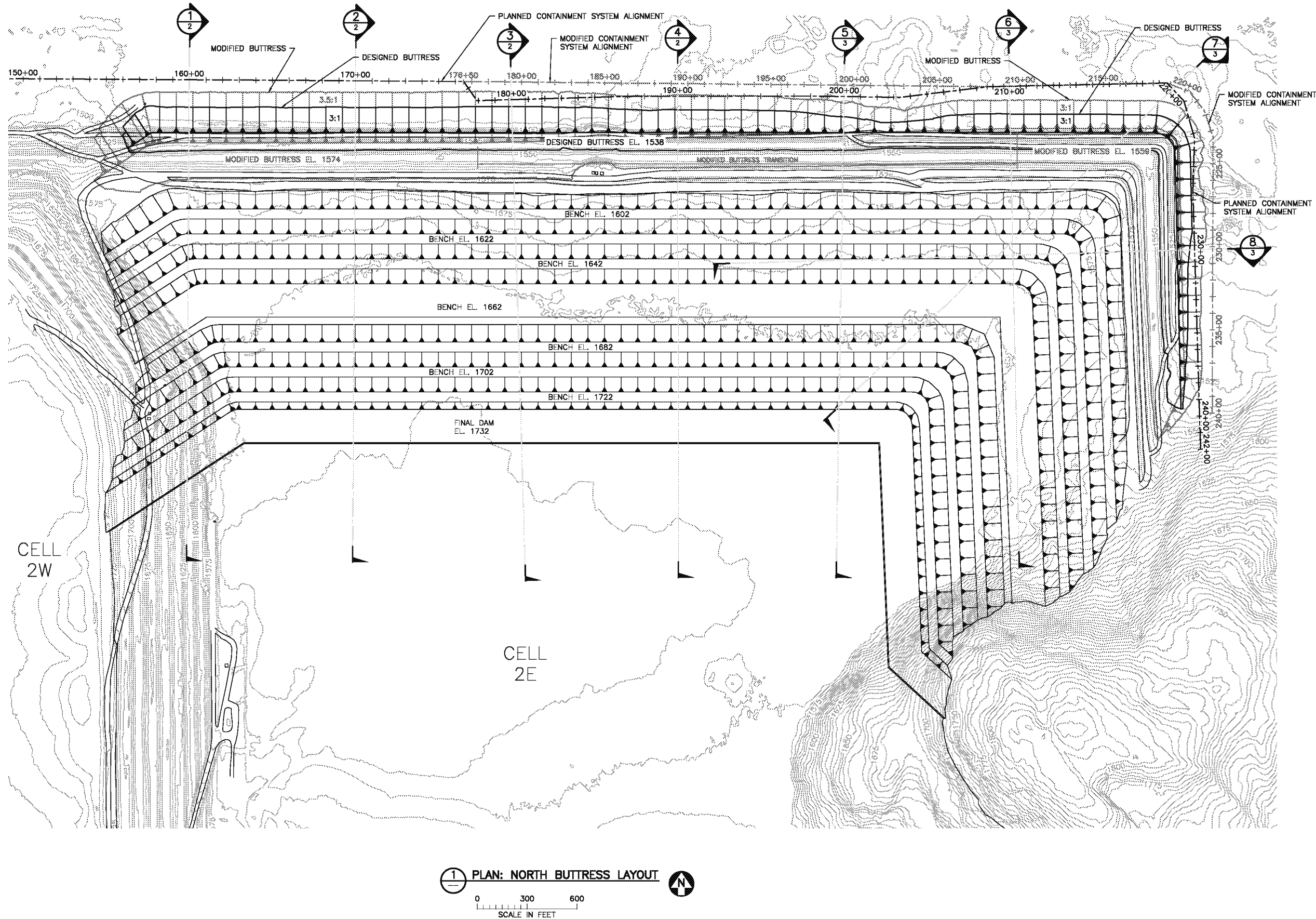


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Thomas J. Radue  
PE #: 20951

### References

1. **Barr Engineering Co.** NorthMet Dam Safety Permit Application - Flotation Tailings Basin. July 2016.
2. **Poly Met Mining Inc.** NorthMet Project Geotechnical Data Package Vol 1 - Flotation Tailings Basin (v7). July 2016.
3. **Barr Engineering Co.** Class II Plant Site Air Quality Dispersion Modeling Report v2 - NorthMet Project. November 2012.
4. **Barr Engineering Company.** Class I Area Air Dispersion Modeling (v2). May 2012.
5. **Barr Engineering Co.** Supplemental Air Emissions Risk Analysis (AERA) – Plant Site, NorthMet Project. March 2013.
6. **Minnesota Department of Natural Resources, U.S. Army Corps of Engineers and U.S. Forest Service.** Final Environmental Impact Statement: NorthMet Mining Project and Land Exchange. November 2015.
7. **Poly Met Mining Inc.** NorthMet Project Water Management Plan - Plant (v5). July 2016.
8. —. Revised Wetland Permit Application (v2). August 19, 2013.



1 PLAN: NORTH BUTTRESS LAYOUT

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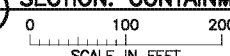
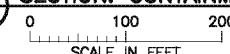
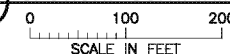
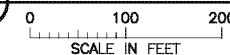
**BARR**  
 Project Office:  
 BARR ENGINEERING CO.  
 4300 MARKETPOINTE DRIVE  
 Suite 200  
 MINNEAPOLIS, MN 55435  
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 Minneapolis, Minnesota  
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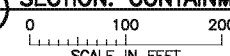
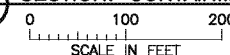
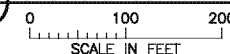
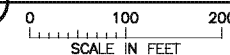
POLY MET MINING, INC.  
 HOYT LAKES, MINNESOTA

NORTHMET PROJECT  
 HOYT LAKES, MINNESOTA  
 FLOTATION TAILINGS BASIN  
 NORTH BUTTRESS

BARR PROJECT No. 23/69-0C29.10	
CLIENT PROJECT No.	
DWG. No. FIGURE 1	REV. No. A



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										 Project Office: BARR ENGINEERING CO. 4300 MARKETPOINTE DRIVE Suite 200 MINNEAPOLIS, MN 55435 Corporate Headquarters: Minneapolis, Minnesota Ph: 1-800-632-2277 Fax: (652) 832-2601 www.barr.com										Scale AS SHOWN Date 10/27/16 Drawn CAD Checked TJR Designed CAD Approved TJR										NORTHMET PROJECT HOYT LAKES, MINNESOTA CLIENT PROJECT No. BARR PROJECT No. <b>23/69-0C29.10</b>									
NO. BY CHK APP DATE REVISION DESCRIPTION										RELEASED TO/ FOR DATE RELEASED										POLY MET MINING, INC. HOYT LAKES, MINNESOTA FLOTATION TAILINGS BASIN NORTH BUTTRESS SECTIONS										DWG. No. FIGURE 3 REV. No. A									

**Figure 4 Future Dam Configuration\_Section F\_Inactive**  
**All Saturated Contrative Soils Liquefied to USSRliq**

**PolyMet Flotation Tailings Basin**  
**Cross-Section F**  
**Date Last Saved: 12/9/2016**  
**File Name: SCS\_SecF\_2016buttress\_Inactive.gsz**

**1.3 Lift 8 - LIQ\_peat wedge (Circular)**  
**Liquefied / Yield USSA strengths**  
**Entry-Exit, Circular**  
**Peat, Till, Fractured Bedrock, and Bedrock Impenetrable**

**Factor of Safety: 1.11**

- Name: Virgin Peat (USSA)    Model: S=f(overburden)    Unit Weight: 70 pcf    Tau/Sigma Ratio: 0.23
- Name: Rock Dam    Model: Mohr-Coulomb    Unit Weight: 140 pcf    Cohesion': 0 psf    Phi': 40 °
- Name: LTVSMC Coarse Tailings    Model: Mohr-Coulomb    Unit Weight: 135 pcf    Cohesion': 0 psf    Phi': 38.5 °
- Name: LTVSMC Fine Tailings    Model: Mohr-Coulomb    Unit Weight: 130 pcf    Cohesion': 0 psf    Phi': 33 °
- Name: LTVSMC Bulk Tailings    Model: Mohr-Coulomb    Unit Weight: 130 pcf    Cohesion': 0 psf    Phi': 38.5 °
- Name: Flotation Tailings (Liquefied)    Model: S=f(overburden)    Unit Weight: 125 pcf    Tau/Sigma Ratio: 0.12
- Name: Flotation Tailings (ESSA)    Model: Mohr-Coulomb    Unit Weight: 125 pcf    Cohesion': 0 psf    Phi': 33 °
- Name: Glacial Till - Impenetrable    Model: Bedrock (Impenetrable)
- Name: Interior LTVSMC FT/Slimes (Liquefied)    Model: S=f(overburden)    Unit Weight: 125 pcf    Tau/Sigma Ratio: 0.1
- Name: LTVSMC FT/Slimes (Liquefied)    Model: S=f(overburden)    Unit Weight: 125 pcf    Tau/Sigma Ratio: 0.1
- Name: Bedrock    Model: Bedrock (Impenetrable)
- Name: Fractured Bedrock -Impenetrable    Model: Bedrock (Impenetrable)
- Name: Compressed Peat (Impenetrable)    Model: Bedrock (Impenetrable)
- Name: Slurry Wall    Model: Mohr-Coulomb    Unit Weight: 70 pcf    Cohesion': 50 psf    Phi': 0 °

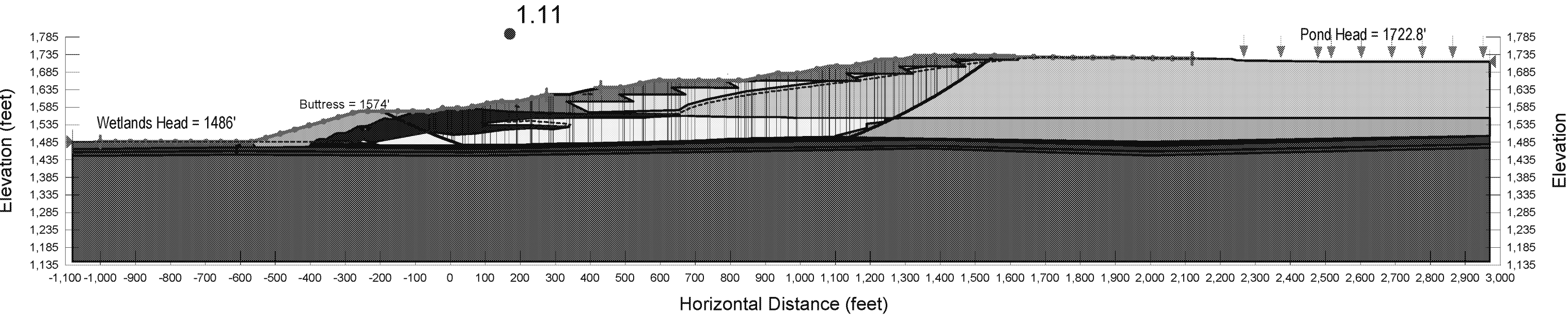


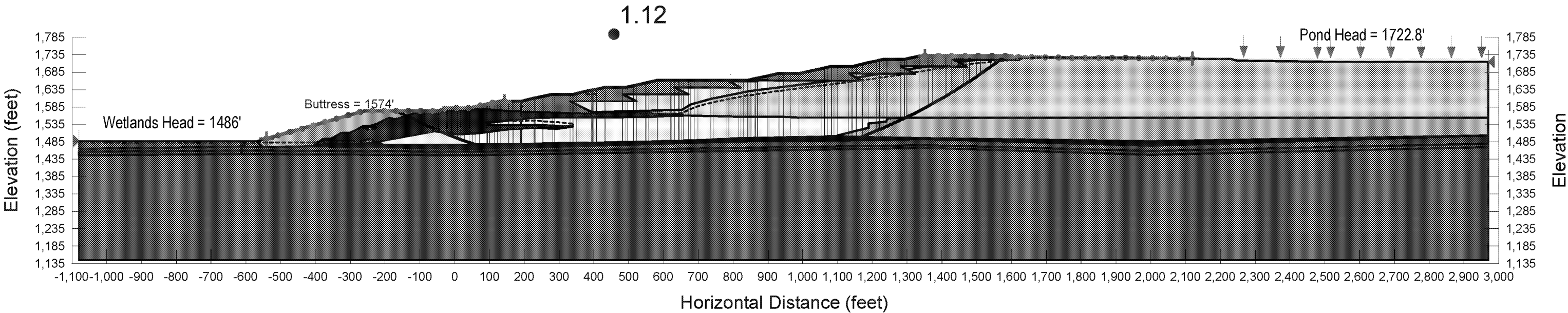
Figure 5 Future Dam Configuration\_Section F\_Active  
All Saturated Contractive Soils Liquefied to USSRliq

PolyMet Flotation Tailings Basin  
Cross-Section F  
Date Last Saved: 12/9/2016  
File Name: SCS\_SecF\_2016buttress\_Active\_12.9.2016.gsz

1.3 Lift 8 - LIQ\_peat wedge (Circular)  
Liquefied / Yield USSA strengths  
Entry-Exit, Circular  
Peat, Till, Fractured Bedrock, and Bedrock Impenetrable

Factor of Safety: 1.12

Name: Virgin Peat (USSA)    Model: S=f(overburden)    Unit Weight: 70 pcf    Tau/Sigma Ratio: 0.23  
Name: Rock Dam    Model: Mohr-Coulomb    Unit Weight: 140 pcf    Cohesion': 0 psf    Phi': 40 °  
Name: LTVSMC Coarse Tailings    Model: Mohr-Coulomb    Unit Weight: 135 pcf    Cohesion': 0 psf    Phi': 38.5 °  
Name: LTVSMC Fine Tailings    Model: Mohr-Coulomb    Unit Weight: 130 pcf    Cohesion': 0 psf    Phi': 33 °  
Name: LTVSMC Bulk Tailings    Model: Mohr-Coulomb    Unit Weight: 130 pcf    Cohesion': 0 psf    Phi': 38.5 °  
Name: Flotation Tailings (Liquefied)    Model: S=f(overburden)    Unit Weight: 125 pcf    Tau/Sigma Ratio: 0.12  
Name: Flotation Tailings (ESSA)    Model: Mohr-Coulomb    Unit Weight: 125 pcf    Cohesion': 0 psf    Phi': 33 °  
Name: Glacial Till - Impenetrable    Model: Bedrock (Impenetrable)  
Name: Interior LTVSMC FT/Slimes (Liquefied)    Model: S=f(overburden)    Unit Weight: 125 pcf    Tau/Sigma Ratio: 0.1  
Name: LTVSMC FT/Slimes (Liquefied)    Model: S=f(overburden)    Unit Weight: 125 pcf    Tau/Sigma Ratio: 0.1  
Name: Bedrock    Model: Bedrock (Impenetrable)  
Name: Fractured Bedrock -Impenetrable    Model: Bedrock (Impenetrable)  
Name: Compressed Peat (Impenetrable)    Model: Bedrock (Impenetrable)  
Name: Slurry Wall    Model: Mohr-Coulomb    Unit Weight: 70 pcf    Cohesion': 50 psf    Phi': 0 °



## Figure 6 Future Dam Configuration\_Section G\_Inactive

### All Saturated Contrative Soils Liquefied to USSRliq

**PolyMet Flotation Tailings Basin**

**Cross-Section G**

**Date Last Saved: 12/12/2016**

**File Name: SCS\_Section G\_Lift 8\_Inactive.gsz**

**1.3 Lift 8 - LIQ\_peat wedge (Circular)**

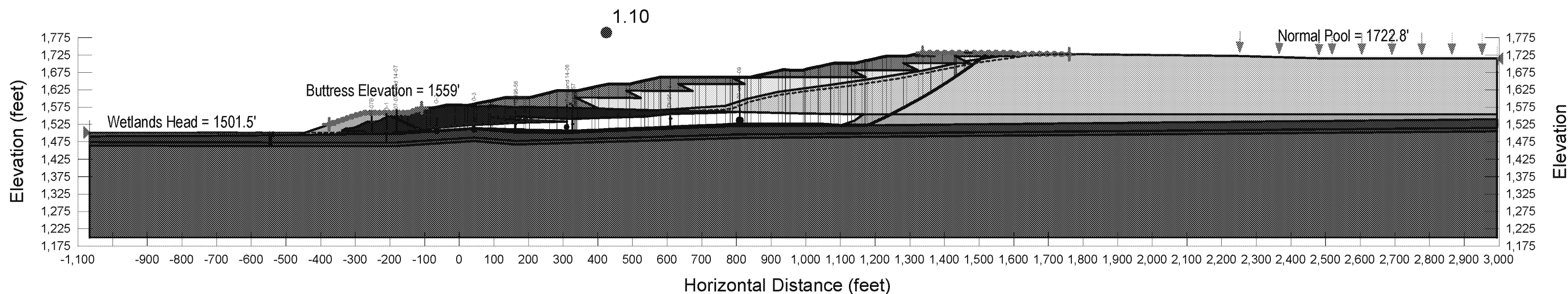
**Liquified / Yield USSA Strengths**

**Entry-Exit, Circular**

**Peat, Till, Fractured Bedrock and Bedrock Impenetrable**

**Factor of Safety: 1.10**

Name: Virgin Peat (USSA) Model: S=f(overburden) Unit Weight: 70 pcf Tau/Sigma Ratio: 0.23  
 Name: Rock Dam Model: Mohr-Coulomb Unit Weight: 140 pcf Cohesion': 0 psf Phi': 40 °  
 Name: LTVSMC Coarse Tailings Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 38.5 °  
 Name: Glacial Till -Impenetrable Model: Bedrock (Impenetrable)  
 Name: Interior LTVSMC FT/Slimes (LIQ) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.1  
 Name: LTVSMC FT/Slimes (LIQ) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.1  
 Name: Bedrock Model: Bedrock (Impenetrable)  
 Name: Flotation Tailings (ESSA) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 °  
 Name: Flotation Tailings (Liquefied) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.12  
 Name: LTVSMC Bulk Tailings Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38.5 °  
 Name: Fractured Bedrock (Impenetrable) Model: Bedrock (Impenetrable)  
 Name: Compressed Peat\_Impenetrable Model: Bedrock (Impenetrable)  
 Name: Slurry Wall Model: Mohr-Coulomb Unit Weight: 70 pcf Cohesion': 50 psf Phi': 0 °



# Figure 7 Future Dam Configuration\_Section G\_Active

## All Saturated Contractive Soils Liquefied to USSRliq

**PolyMet Flotation Tailings Basin**

**Cross-Section G**

**Date Last Saved: 12/12/2016**

**File Name: SCS\_Section G\_Lift 8\_Active.gsz**

**1.3 Lift 8 - LIQ\_peat wedge (Circular)**

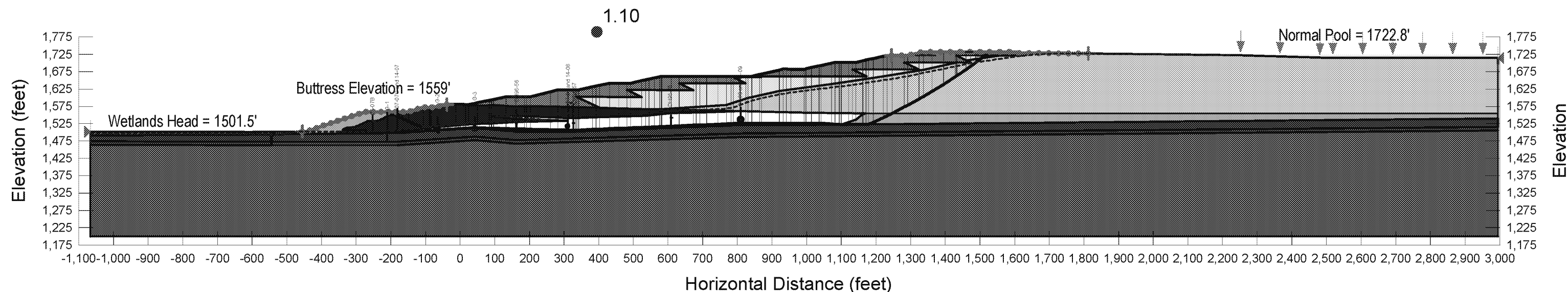
**Liquified / Yield USSA Strengths**

**Entry-Exit, Circular**

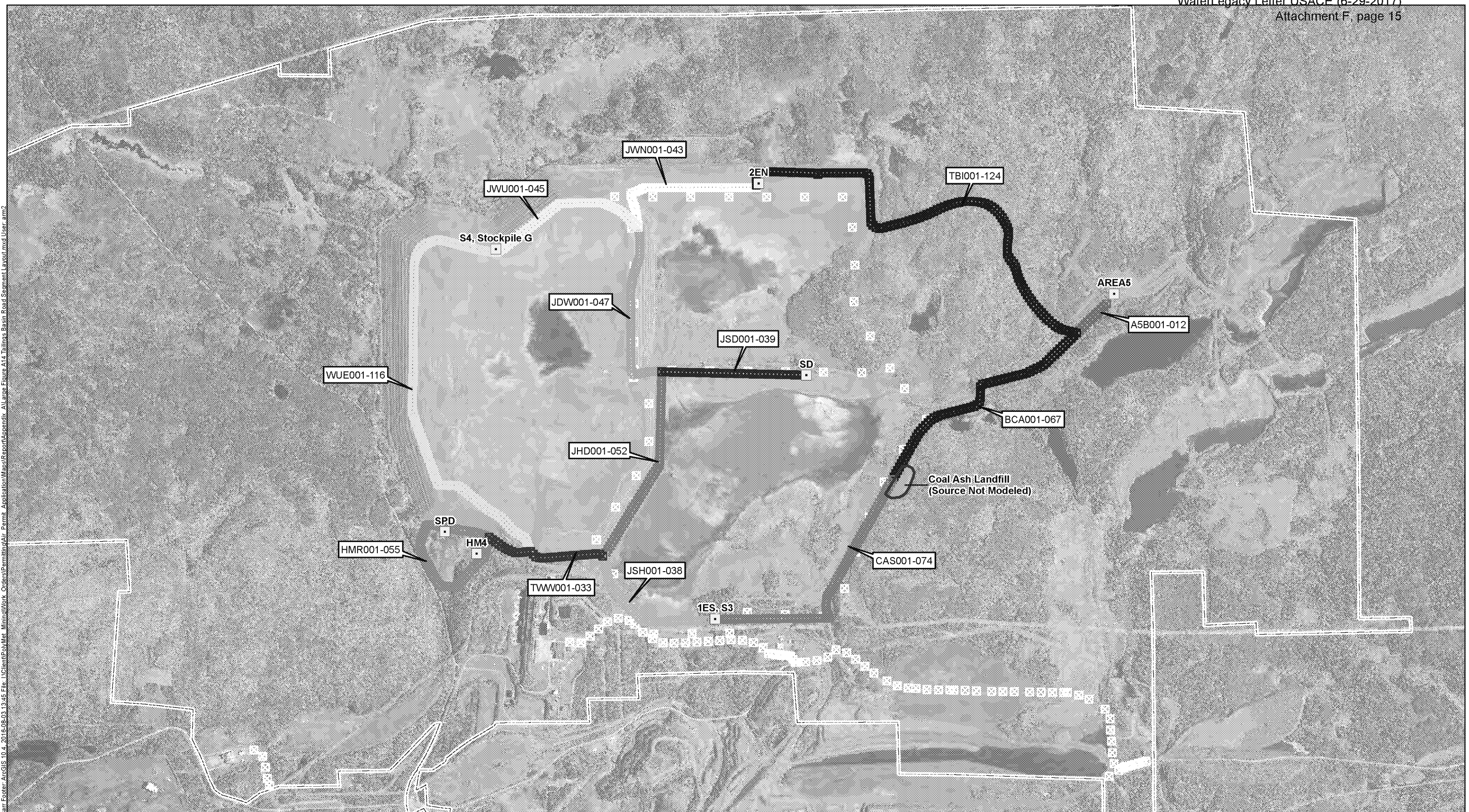
**Peat, Till, Fractured Bedrock and Bedrock Impenetrable**

**Factor of Safety: 1.10**

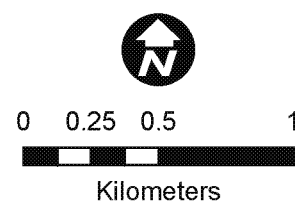
Name: Virgin Peat (USSA) Model: S=f(overburden) Unit Weight: 70 pcf Tau/Sigma Ratio: 0.23  
 Name: Rock Dam Model: Mohr-Coulomb Unit Weight: 140 pcf Cohesion': 0 psf Phi': 40 °  
 Name: LTVSMC Coarse Tailings Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 38.5 °  
 Name: Glacial Till -Impenetrable Model: Bedrock (Impenetrable)  
 Name: Interior LTVSMC FT/Slimes (LIQ) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.1  
 Name: LTVSMC FT/Slimes (LIQ) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.1  
 Name: Bedrock Model: Bedrock (Impenetrable)  
 Name: Flotation Tailings (ESSA) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 °  
 Name: Flotation Tailings (Liquefied) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.12  
 Name: LTVSMC Bulk Tailings Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38.5 °  
 Name: Fractured Bedrock (Impenetrable) Model: Bedrock (Impenetrable)  
 Name: Compressed Peat\_Impenetrable Model: Bedrock (Impenetrable)  
 Name: Slurry Wall Model: Mohr-Coulomb Unit Weight: 70 pcf Cohesion': 50 psf Phi': 0 °



Barr Footer: ArcGIS 10.4, 2018-08-03 13:45 File: \\Client\PolyMet\_Mining\Work\_Orders\Permitting\Air\_Permits\_Application\Map\Report\Appendix All area Figure A14 Tailings Basin Road Segment Layout.mxd User: am2



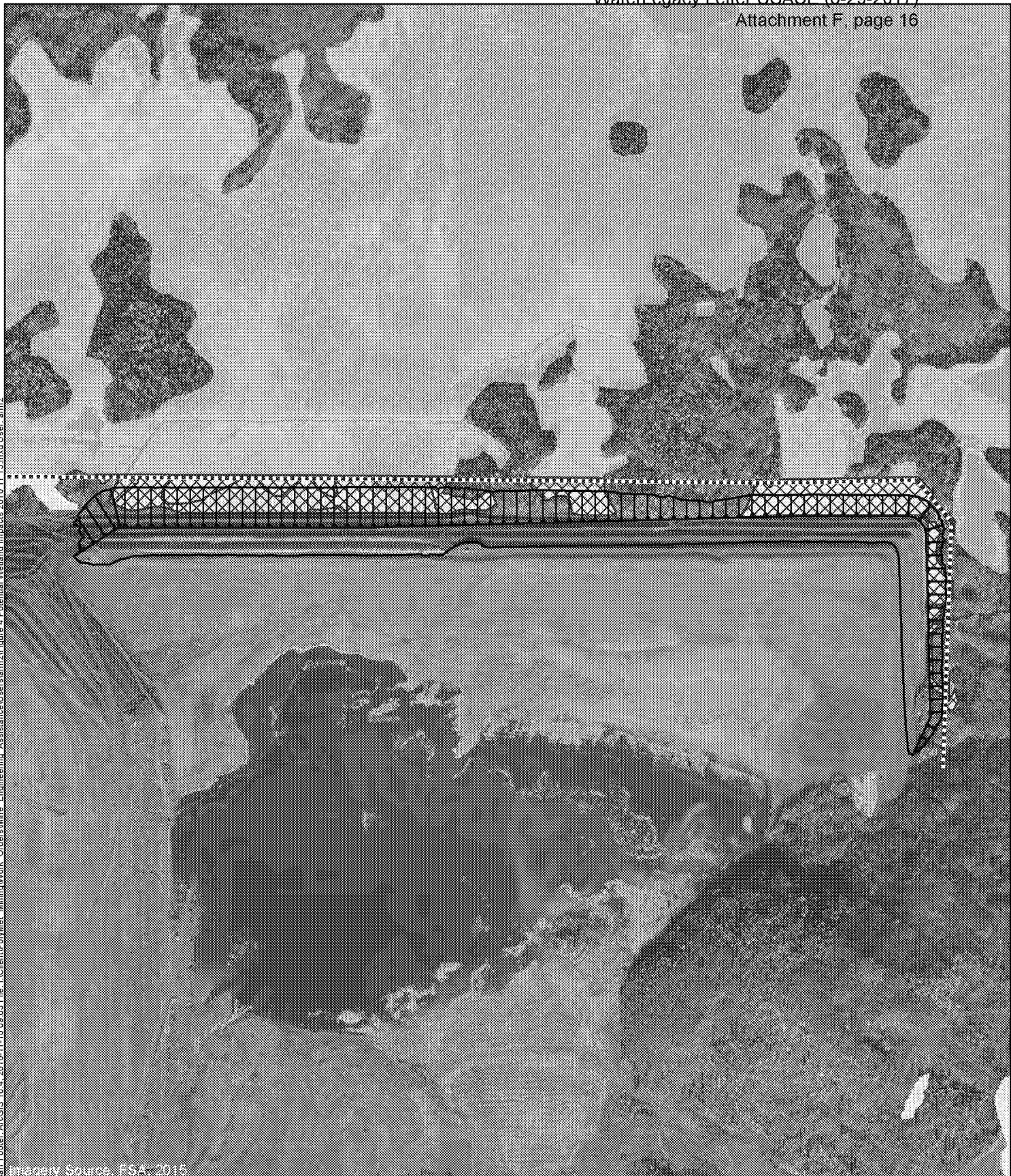
- Tailings Handling Sources
- Plant Site Ambient Air Boundary






TAILINGS BASIN  
ROAD SEGMENT LAYOUT  
NorthMet Project  
Poly Met Mining, Inc.

Figure 8

Barr Footer: ArcGIS 10.4, 2016-11-18 09:03 File: I:\Client\PolyMet\_Mining\Work Orders\Mine\_Engineering\_Assistance\Users\arm2\Figure 4 Potential Wetland Impacts 2016 11 15.mxd User: arm2



- ..... Modified FTB Seepage Containment System
- Modified Buttress Layout
-  Potential Wetland Impacts Due to Modified Buttress/Containment System (32.14 acres)
-  Previously Identified Direct Wetland Impacts (29.17 acres)
-  Wetlands

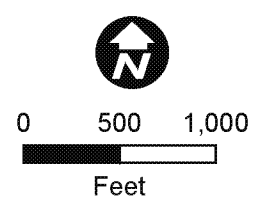


Figure 9  
POTENTIAL WETLAND IMPACTS  
NorthMet Project  
Poly Met Mining Inc.

**Table 5.2.14-1 Summary of Stability Modeling Results**

Cross-Section Location	Cross-Section F			Cross-Section G			Cross-Section N		
Case	USSA yield	ESSA	USSA liq	USSA liq	ESSA	USSA liq	USSA yield	ESSA	USSA liq
Target Factor of Safety	1.3	1.5	1.1	1.3	1.5	1.1	1.3	1.5	1.1
Design Scenarios – Steady State Seepage									
Existing Conditions	-	1.83	-	-	2.21	-	-	3.11	-
Interim Lift 2	1.89	3.12	-	2.28	3.43	-	-	-	-
Interim Lift 4	1.74	3.18	-	2.09	3.42	-	-	-	-
Interim Lift 6	1.88	3.18	-	1.93	3.43	-	1.88	4.43	-
Interim Lift 8 – Normal Pool	1.69	3.17	-	1.86	3.44	-	2.00	4.58	-
Interim Lift 8 – PMP Event	1.77	3.18	-	1.85	3.46	-	1.91	4.34	-
Long-Term Stability – Steady State Seepage									
End of Operations	-	3.07	-	-	-	-	-	-	-
20 Years after Closure	-	3.09	-	-	-	-	-	-	-
200 Years after Closure	-	3.21	-	-	-	-	-	-	-
2,000 Years after Closure	-	3.15	-	-	-	-	-	-	-
Cross-Section F Liquefaction Triggering Analysis									
Baseline	2.06	-	-	-	-	-	-	-	-
Plugged Drain	2.06	-	-	-	-	-	-	-	-
Lift 1 Rapid Loading	-	-	1.78	-	-	-	-	-	-
Erosion	1.99	-	-	-	-	-	-	-	-
Plugged Drain	1.91	-	-	-	-	-	-	-	-
Fully Liquefied with Unknown Trigger									
Operations	-	-	1.10	-	-	1.25	-	-	1.16
20 Years after Closure	-	-	1.35	-	-	-	-	-	-
200 Years after Closure	-	-	1.45	-	-	-	-	-	-
2,000 Years after Closure	-	-	1.53	-	-	-	-	-	-

Source: PolyMet 2015I

Notes:

USSA = Undrained Strength Stability Analysis

ESSA = Effective Strength Stability Analysis

Liq = Liquefied conditions

Yield = point of elastic deformation

**Liquefaction**

The potential for liquefaction, where a triggering event changes the stress state of the material such that it loses a significant amount of its strength, was assessed under different scenarios, including rapid loading and construction, ineffective underdrain resulting in increased saturation, and erosion events. Results shown in Table 5.2.14-1 indicate that the design under these conditions meets the minimum Factor of Safety for Cross Sections F, G, and N.

A scenario for potential liquefaction was evaluated whereby all contractive, saturated soils were modeled with their liquefied shear strengths. Table 5.2.14-1 shows that if the contractive, saturated soils were to liquefy at the end of operations, or 20, 200, or 2,000 years after operations, the design would meet the minimum Factors of Safety deemed acceptable by the Co-lead Agencies.

Potential for seismic activity was also analyzed and assessed. Results indicated that there is a very low likelihood of liquefaction as a result of seismic events.



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**Table 3-3 Modeled Factors of Safety for Liquefaction Triggering Analyses (Cross-Section F)**

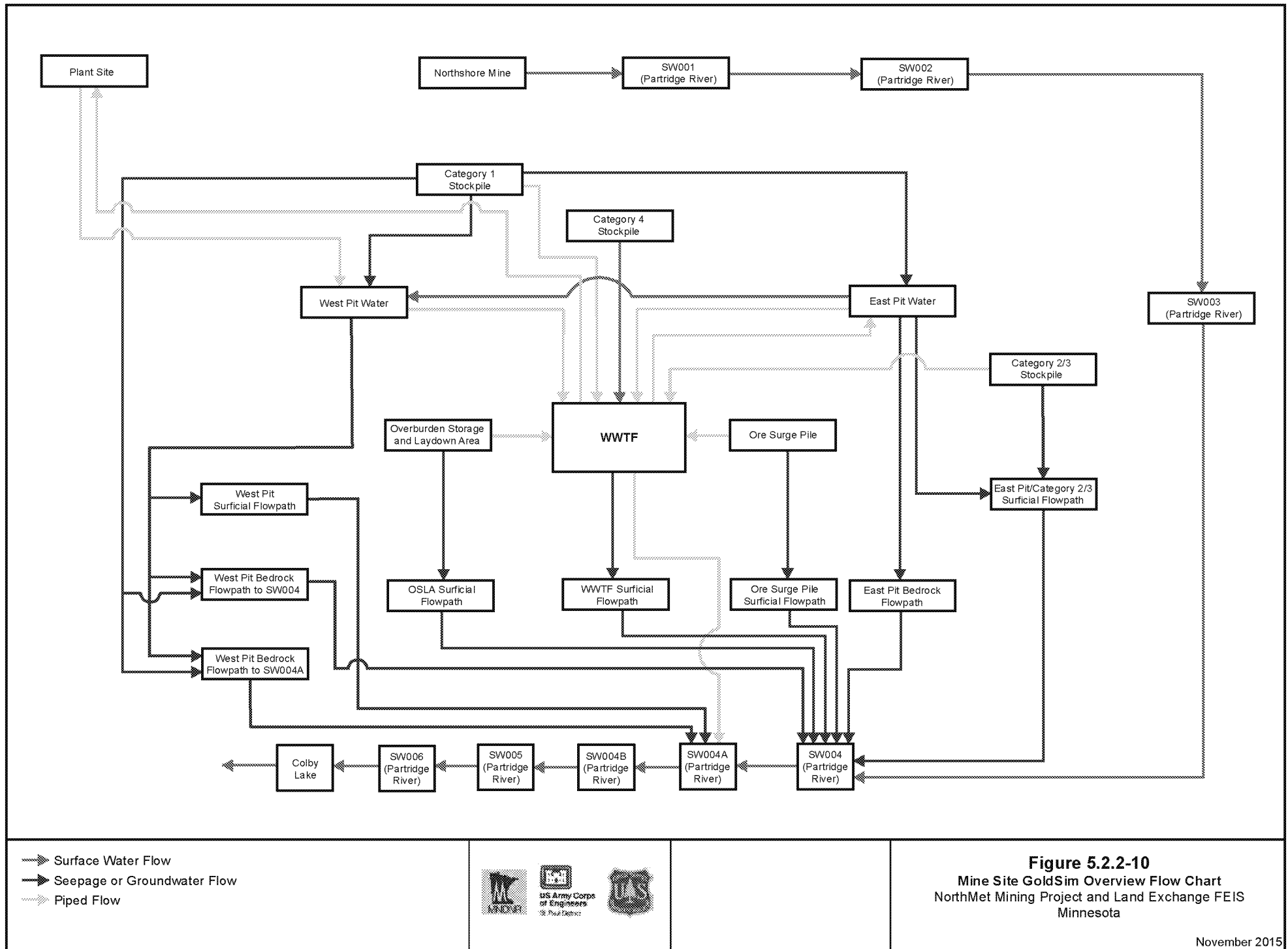
Liquefaction Triggering Scenario	Slope Stability FOS <sub>overall</sub>	Slope Stability Average FOS <sub>triggering</sub> for Liquefaction Susceptible Slices
<b>Required Factor of Safety</b>	<b>≥ 1.1</b>	<b>≥ 1.1</b>
Baseline	2.13	2.13
Rapid Loading - fast construction of Lift 1	1.78	1.90
Erosion - Local erosion/pipe scour	1.07	--
Plugged Drain Lift 1	1.91	1.91
Plugged Drain Lift 8	2.12	2.12

(1) Simplified analysis approach used in Geotechnical Data Package – Vol. 1 – Ver. 8; detailed analysis approach yields FOS >1.10 (nearly 2.0).

Stability analysis for a worst-case flow liquefaction event based on an unknown trigger was also evaluated. The DNR has requested that the safety factor for this condition be equal to or greater than 1.1. The results for this worst-case condition show that estimated slope stability safety factors are equal to or above the required value (Table 3-4). The modeled value for Cross-Section F is equal to 1.1 because the dams are configured on the basis of this worst-case scenario. Other slope stability conditions are much more likely; hence the dams typically have a relatively high safety factor in comparison to safety factor requirements.

**Table 3-4 Modeled Factors of Safety for Worst-Case Flow Liquefaction (USSA<sub>liq</sub>) Conditions (Cross-Section F)**

Case	Slip Surface	Slope Stability FOS <sub>overall</sub>		
<b>Required Factor of Safety</b>		<b>≥ 1.1</b>		
<b>Cross-Sections Analyzed</b>		<b>Section F</b>	<b>Section G</b>	<b>Section N</b>
All Saturated Contractive Materials Liquefied to USSA <sub>liq</sub>	Circular	1.26	1.36	1.16
	Wedge	1.10	1.10	1.16



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## Technical Memorandum

**To:** Ann Foss, Minnesota Pollution Control Agency; Jess Richards, Minnesota Department of Natural Resources; Kenton Spading, U.S. Army Corps of Engineers  
**Prepared for:** Poly Met Mining, Inc.  
**From:** Don E. Richard, PhD, P.E.  
**Subject:** Proposed Waste Water Treatment System (WWTS) Relocations (Version 3)  
**Date:** April 11, 2017  
**c:** Jennifer Saran, Christie Kearney, PolyMet

### 1.0 Introduction

Poly Met Mining, Inc. (PolyMet) is proposing to modify the footprint of the waste water treatment system (WWTS) for its NorthMet Project (Project), by combining the Mine Site Waste Water Treatment Facility (WWTF) and the Plant Site Waste Water Treatment Plant (WWTP) into a single building located at the Plant Site, at the location of the former WWTP. The WWTS building would be approximately 33% larger than the former WWTP (81,000 square feet instead of 61,000 square feet), and it would contain all the treatment processes formerly housed in the two separate buildings. These changes would have environmental effects that are either the same as those evaluated in the Final Environmental Impact Statement (FEIS) (Reference (1)) or result in some relatively small, but nonetheless important, reductions in environmental effects.

The location for the WWTS, at the location of the former WWTP, is shown on Large Figure 1. At the Mine Site, the WWTF would be eliminated and the equalization basins would be relocated to the south of Dunka Road as shown on Large Figure 2. To transport mine water to the Plant Site for treatment, the single Treated Water Pipeline would be replaced by a three pipeline system. The three Mine to Plant Pipelines would deliver three types of mine water (high concentration mine water, low concentration mine water, and construction mine water) to their respective destinations at the Plant Site (additional details below). Piping relocations necessary to accommodate these changes are shown on Large Figure 1, Large Figure 2, and Large Figure 3. These changes will not increase the proposed corridor width along the Transportation and Utility Corridor or the wetland impacts along the Transportation and Utility Corridor.

There would be a number of benefits from these relocations. PolyMet planned to transport WWTS byproducts and waste streams back and forth between the Plant Site and the Mine Site. With all WWTS operations under one roof, this transport would no longer be necessary. This increased efficiency would require less energy and truck traffic, and eliminate the need to haul WWTS-related material via trains. The one-roof configuration would also allow more efficient use of the treatment units and reduce capital outlays for the Project. The water quality and rate of the treated discharge to the environment and to the FTB Pond would be the same as were evaluated for the FEIS. In addition, the removal of the WWTF and

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relocation of the Equalization Basin Area will result in 7.9 fewer acres of wetland impacts, including 7.8 acres of direct impact and 0.1 acres of indirect impact (fragmentation).

The following sections describe the proposed WWTS relocations (Section 2), compare the environmental effects of the proposed WWTS relocations with those evaluated in the FEIS (Section 3), and summarize potential ripple effects across the various permitting efforts that are in progress (Section 4).

## **2.0 WWTS Relocations**

The WWTS relocations would modify the physical location and structure of the treatment buildings and collection ponds. Overall, the WWTS would still have the same treatment units and would continue to meet the stated treatment objectives for the system as described in the FEIS, the NPDES/SDS permit application and the Permit to Mine application, while increasing treatment efficiency and reducing environmental effects.

The WWTS evaluated in the FEIS (as described in the WWTS Design and Operation Report (Reference (2))) was developed as an integrated system for managing the quality of water discharged from the Project to the surrounding environment. The design to house waste water treatment in separate facilities housed at both the Mine Site and the Plant Site was based primarily on the iterative nature of the Project development. Waste water treatment for the Project was originally proposed just at the Mine Site, as described in the Draft Environment Impact Statement, to treat mine water prior to sending it to the Tailings Basin. As the Project evaluation progressed, a separate Waste Water Treatment Plant (WWTP) was added to treat water at the Plant Site prior to the discharge, which was needed to supplement streamflow downstream of the Tailings Basin, as described in the Supplemental Draft Environmental Impact Statement. The modifications to the WWTS proposed in this memorandum would integrate the two operations into a single building at the Plant Site (at the location of the WWTP).

### **2.1 Physical Modifications**

The WWTS relocations would consist of the following physical modifications:

- All of the same treatment processes described in the Design and Operation Report (Reference (2)) would be combined into a single treatment building, which would be located at the Plant Site in the same location that was proposed for the WWTP. Large Figure 4 and Large Figure 5 show the general arrangement of the “under-one-roof” WWTS.
- The Waste Water Treatment Facility (WWTF) would be eliminated from the Mine Site and the Central Pumping Station and the mine water equalization basins would be relocated to a new location south of Dunka Road. Large Figure 2 shows the location of the Equalization Basin Area, and Large Figure 3 shows the proposed layout of the equalization basins. The Low and High Concentration Equalization Basins would have the same storage capacity and have the same liner design as the previous design provided in the Waste Water Treatment System: Design and

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Operation Report (Reference (2)), therefore leakage rates from the equalization basins would be the same. The Construction Mine Water Basin is smaller than originally proposed, in order to fit in the available Equalization Basin Area footprint, however it will still provide the necessary volume required to manage this water between the construction areas and the FTB by optimizing the pump sizing associated with the construction mine water.<sup>1</sup>

- The pumps and equipment in the former Splitter Structure Building would be integrated into an expanded Central Pumping Station (CPS) near the relocated equalization basins.
- The Treated Water Pipeline would be replaced with three separate pipelines to convey water between the Mine Site and the Plant Site within the same pipeline corridor. The two pipelines carrying mine water from the Mine Site equalization basins would be extended to the Plant Site WWTS building, and the pipeline carrying construction mine water would be routed to the FTB, consistent with what was presented in the FEIS. These pipelines would have flow meters at both ends of each pipe for leak detection. A cross-section of the proposed Mine to Plant Pipelines is included on Large Figure 3.
  - When treated water is needed during operations to manage water levels in the East Pit, it would be pumped from the WWTS via the Construction Mine Water Pipeline. When East Pit backfill begins in Mine Year 11, runoff from the Overburden and Laydown Area (OSLA), which reports to the Construction Mine Water Basin, would be routed directly to the East Pit, making the Construction Mine Water Pipeline available to transport treated water from the WWTS to the Mine Site. These two operating scenarios will not occur simultaneously. No construction mine water will need to be managed after Mine Year 11 as all of the mine feature construction will be completed. East Pit water level management will need to start in Mine Year 12, after the Category 4 waste rock is disposed of in the pit. At that time, the Construction Mine Water Pipeline would be available to use for sending water from the WWTS to the East Pit because no more construction mine water will be generated. For the FEIS evaluation, the water used to manage water levels in the East Pit included both OSLA runoff and treated water from the WWTF, so this operation remains consistent with that analysis. The Construction Mine Water Pipeline would be sized to accommodate flows of treated water needed to manage East Pit water levels as well as construction mine water, recognizing that these would be two separate operating scenarios for this pipeline. In addition, the Construction Mine Water Pipeline would be extended to the WWTS prior to Mine Year 12 to deliver treated

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<sup>1</sup> The previous Construction Mine Water Basin was designed based on the size of the available area and the construction phase of the Project rather than the design requirements during operations. The basin has been designed to manage groundwater inflows to construction areas (the largest source of water that will be sent to the pond) plus 4.8 inches per month of stormwater runoff during the operations phase. Construction mine water during the construction phase will be managed through a combination of this pond and the equalization basins..

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water back to the Mine Site in Mine Year 12. This extension would follow the same route as the other two proposed Mine to Plant Pipelines.

- Likewise, during reclamation and closure (during West Pit flooding and East Pit flushing), the Construction Mine Water Pipeline would be used to return treated water from the WWTS to the East Pit, and the Construction Mine Water Pipeline would be sized to also accommodate flows of treated water needed for East Pit flushing during this period.
  - This piping configuration and water management in connection with the WWTS will not change quantities or rates of treated water being conveyed to the Mine Site relative to the conveyances reviewed in the FEIS.
- The rail spur needed for WWTP concentrate management at the Mine Site would be eliminated.

The modifications would necessitate limited changes in terminology with regard to the components of the WWTS, as summarized in Table 1.

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**Table 1 WWTS Terminology Changes**

Current name	Proposed name	Notes
Waste Water Treatment Plant (WWTP) and Waste Water Treatment Facility (WWTF)	Waste Water Treatment System (WWTS)	The two sets of treatment trains that were previously at two locations would now be housed under one roof at the Plant Site.
Treated Water Pipeline	As a whole: <ul style="list-style-type: none"> <li>• Mine to Plant Pipelines (MPP)</li> </ul> Three individual pipes: <ul style="list-style-type: none"> <li>• Construction Mine Water Pipeline</li> <li>• Low Concentration Mine Water Pipeline</li> <li>• High Concentration Mine Water Pipeline</li> </ul>	These pipelines would also be used to pump water from the Plant Site to the Mine Site for East Pit filling and to flood the West Pit.
Construction Mine Water Basin	Construction Mine Water Basin	
West Equalization Basin	High Concentration Equalization Basin (HCEQ Basin)	
East Equalization Basin 1	Low Concentration Equalization Basin 1 (LCEQ Basin 1)	
East Equalization Basin 2	Low Concentration Equalization Basin 2 (LCEQ Basin 2)	
WWTP effluent (discharged to receiving waters)	WWTS discharge	
WWTF effluent (sent to the FTB via the CPS)	Treated mine water (WWTS stream pumped to the FTB)	Formerly "treated mine water", which included WWTF effluent, OSLA runoff, and construction mine water. With reconfiguration, that mixture no longer exists, and the "treated mine water" would consist of effluent from the chemical precipitation and membrane filtration portion of the WWTS.
Treated mine water	Treated mine water	"Treated mine water" formerly included WWTF effluent, OSLA runoff, and construction mine water. With reconfiguration, that mixture no longer exists, but these flows still report to the FTB.
Central Pumping Station	Central Pumping Station	The Central Pumping Station would be combined with the Splitter Structure.
--	Equalization Basin Area	New term describing pond area south of Dunka Road
Splitter Structure	--	This structure would be integrated into the Central Pumping Station.
CPS Pond		This pond no longer exists.

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## **2.2 Internal Treatment Plant Flow and Process Modifications**

The new operation within the single WWTS building would contain all of the same treatment units and the same operating configuration as proposed in the previous two-building system. Large Figure 4 and Large Figure 5 show the general layout for the combined WWTS building, and Large Figure 6 shows the process flow diagram for the WWTS. The primary membrane operations within the single WWTS building would remain independent for the treatment of mine water and the treatment of FTB seepage capture systems water, as was the case with the two-building system. Treated mine water would continue to be routed to the FTB Pond for further removal of mercury. Treated FTB seepage would be discharged to the environment in the same quantity and quality and from the same locations. The secondary membrane operations would treat the same volume of water, and the secondary membrane concentrate would continue to be routed to the chemical precipitation treatment train.

Because the WWTS treatment process would be the same, and in particular the quantity and quality of treated water discharged to the environment would not change, the modeling included in the existing NPDES/SDS and Permit to Mine applications is not affected. Accordingly, the model results remain valid and need not be revised in connection with the WWTS relocations.

## **2.3 Comparison of FEIS and WWTS Relocations**

Large Figure 7 through Large Figure 10 compare the flows evaluated for the FEIS with the flows for the WWTS during operations, reclamation, closure, and postclosure maintenance.

During operations (Large Figure 7 and Large Figure 8), mine water would be sent to the Plant Site via the Mine to Plant Pipelines located within the Transportation and Utility Corridor, along the alignment planned for the Treated Water Pipeline. The construction mine water would go to the FTB Pond, as it previously had in the FEIS (i.e., previously combined with the treated mine water at the CPS Pond, which was then routed through the Treated Water Pipeline to the FTB Pond). The high concentration mine water would report to chemical precipitation treatment units at the WWTS, and the low concentration mine water would report to membrane filtration treatment units at the WWTS, as was the case in the FEIS configuration of the WWTF. Treated mine water from the membrane separation and chemical precipitation treatment units at the WWTS would be routed to the FTB Pond. When East Pit backfilling begins in approximately Mine Year 11, treated mine water would be routed back to the Mine Site through the Construction Mine Water Pipeline. Treated mine water and OSLA runoff would both be used in water level management during East Pit backfill, with that operation proceeding at the same rate of backfill and water level management as evaluated for the FEIS and with the same type of water as was evaluated for the FEIS. Accordingly, the WWTS relocations would result in no change in management of water from the FTB seepage capture systems as compared to the prior configuration: some water would be returned to the FTB Pond, and some water would be sent to the WWTS for treatment and then discharged under the terms of an NPDES/SDS Permit and the Water Appropriation permits. The quantity, quality, and location

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of discharge to the environment would be unchanged from what was evaluated in the FEIS and NPDES/SDS permit application, Water Appropriation permit application, and the Permit to Mine application.

During reclamation and closure (Large Figure 9), mine water would be sent to the WWTS for treatment and treated water would be returned to the Mine Site to flush the East Pit and to accelerate flooding of the West Pit, at the same rate as evaluated for the FEIS. As during operations, the WWTS relocations would result in no change from the prior configuration in the management of water from the FTB seepage capture systems during reclamation and closure, and the quantity, quality, and location of discharge to the environment would be unchanged from what was evaluated in the FEIS and Permit to Mine applications. At the beginning of the reclamation phase three of the four EQ basins and one of the Mine to Plant pipelines would be reclaimed. One EQ basin and two Mine to Plant pipelines would remain in use. The basin and one pipeline would be used to send mine water from the East Pit and the Category 1 Waste Rock Stockpile to the WWTS. The second pipeline would be used to send treated water back to the Mine Site for flushing the East Pit and flooding the West Pit.

During postclosure maintenance (Large Figure 10), while mechanical water treatment continues, mine water would be sent to the WWTS for treatment and returned to the Mine Site for discharge to the environment at the same rates and quantities as evaluated for the FEIS. One EQ basin and two Mine to Plant pipelines would remain in use during this phase. The basin and one pipeline would be used to send mine water from the West Pit and the Category 1 Waste Rock Stockpile to the WWTS. The second pipeline would be used to send treated water back to the Mine Site for discharge. As with previous phases, the WWTS relocations would result in no change in management of water from the FTB seepage capture systems and the quantity, quality, and location of discharge to the environment would be unchanged from what was evaluated in the FEIS and Permit to Mine application.

The WWTS relocations would result in no changes to the planned transition to non-mechanical (passive) treatment, which will need to be demonstrated prior to implementation, as described in the FEIS and Permit to Mine application.

Safety inspections and emergency response procedures for the relocated Equalization Basin Area would be the same as those laid out in the WWTS Design and Operation Report (Section 4.4.1 of Reference (2)). As planned for in the previous location, the equalization basins will have water level control systems to automatically shut off incoming flow before the basins reach full capacity. In addition, a high-water-level alarm will alert the operators so that overfilling does not occur. The control room at the WWTS will have water level monitoring of the equalization basins, and the Equalization Basin Area will be visually inspected at least once per shift.

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## 2.4 Operating Efficiencies

The WWTS relocations would result in the following operating efficiencies:

- Waste water treatment plant concentrate would not need to be shipped via trains between the two treatment buildings, reducing the total railcar usage and associated emissions and safety concerns for the Project, and eliminating the need for a rail spur at the Mine Site.
- Chemicals used in the precipitation process would not need to be trucked or hauled by rail to the Mine Site.
- The hauling distance of solids generated from the chemical precipitation process to the HRF, once operational, would be significantly reduced, because the chemical precipitation process would be located at the Plant Site instead of the Mine Site.
- Heating requirements and associated utility costs and maintenance needs for a single building would be reduced in comparison to two buildings.
- Infrastructure costs and operations and maintenance requirements at the Mine Site would be reduced by eliminating the WWTF building, integrating the Splitter building into the Central Pumping System (CPS) building, and eliminating the CPS Pond from the Project.
- Staffing, potable water and sewage operations, instrumentation, monitoring, and control systems would be streamlined by being in a single location.

As discussed in Section 3, these operational efficiencies would have environmental effects that are either the same as those evaluated in the FEIS or result in some relatively small, but nonetheless important, reductions in environmental effects.

In addition to these immediate operational efficiencies, having all of the water treatment process equipment at a single location provides additional redundancy between process units and allows the potential for greater operating flexibility and improvement through adaptive management during the operations phase of the Project.

## 3.0 Environmental Outcomes

PolyMet evaluated whether the WWTS relocations would change the environmental effects that were evaluated in the FEIS and permit applications. The water quality and rate of the treated discharge to the environment would be the same as were evaluated for the FEIS. Air quality impacts would be unchanged, or potentially slightly decreased, due to the improved efficiency of the proposed modifications. Wetland impacts would slightly decrease, and no additional cultural resource impacts would be expected. More detailed results are discussed below.

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### 3.1 Surface Water and Groundwater Quality

WWTS discharge quantity, quality, and location of discharge to the environment would be unchanged during operations, reclamation, closure, and postclosure maintenance, as described in Section 2.2. There would be no change in the type, amount, or rate of water supplied to the Mine Site in the pertinent timeframes to accelerate mine pit flooding, so waste rock in the East Pit would be submerged at the same rate evaluated for the FEIS and the West Pit flooding would also be consistent with the FEIS. There would be no change with regard to compliance with applicable effluent limits and new source performance standards in 40 CFR part 440, as described in Section 5 of Volume III of the NPDES/SDS permit application. Therefore, water quality effects in receiving and downstream waters would be the same as were evaluated for the FEIS and in the Project permit applications. Other potential effects on surface and groundwater quality due to the WWTS relocation could include:

- The addition of two new Mine to Plant pipelines (for a total of three) could theoretically increase the potential for leakage or a pipeline rupture. However, the pipelines will be located along travel corridors for ease of inspection and equipped with a leak detection system through the use of flow meters to monitor the flow into and out of the pipelines. Additionally, these pipelines are designed for local climatic conditions by being covered in a minimum of eight feet of material for protection against frost and protection against direct impact to the pipelines.
- Relocation of the equalization basins would slightly shorten the time for any liner leakage to groundwater to reach the property boundary. This would be a minor effect, because minimal leakage is expected from the highly efficient equalization basin composite liner system. Initial breakthrough of groundwater flow from equalization basin leakage to the Partridge River was estimated for the FEIS to be at approximately Mine Year 85 (Table 5.2.2-22 of Reference (1)). The reduction in flow path length by approximately 10% would proportionally shorten the breakthrough time to approximately Mine Year 76. This change will not result in any estimated non-compliance by the Project with applicable water quality standards. The evaluation of compliance with groundwater quality standards will remain unchanged. In particular, there will be no changes relative to the monitoring well design included in the FEIS with respect to locations of: performance monitoring wells immediately downstream of the basins, indicator wells between the basins and the compliance point, and compliance wells at the groundwater compliance point upgradient of the Partridge River excepted as noted in bullet below; therefore this system continues to allow sufficient time to identify a potential change in groundwater quality and initiate contingency mitigation.
- Relocation of the equalization basins would force abandonment of one existing surficial aquifer monitoring well (MW-5) that was proposed for continued monitoring in the NPDES/SDS permit application. The potential need for a replacement surficial aquifer well in this area would be discussed with the MPCA for NPDES/SDS permitting. No other changes to monitoring locations would be needed.

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- The impervious surface area at the Mine Site would be decreased by 11.1 acres, which would reduce the stormwater volumes associated with the Project and thus reduce the amount of watershed reduction from the Partridge River. Runoff from the WWTF was planned to be routed to a stormwater basin within the treatment area footprint, then routed south offsite. Large Figure 2 shows the culverts that will route stormwater offsite under both plans. At the Plant Site the amount of impervious area will slightly increase, from 1.4 acres to 1.9 acres.

### 3.2 Air Quality

The primary air effects from the WWTS relocations have been evaluated. PolyMet expects an overall reduction in actual air emissions because of the WWTS relocations. The following provides an overview of the primary changes associated with the WWTS relocations that relate to air quality effects:

- The WWTF building would be removed from the air dispersion model configuration.
- The WWTS footprint would be larger than the WWTP footprint (relevant for air dispersion modeling).
- The increased heating demand for the larger footprint of the WWTS is accommodated with the current safety factor that was provided for heating calculations of the previous WWTP building, so there would be no change in the potential air emissions at the Plant Site as a result of heating.
- A lime silo and mix tank would be located at the WWTS at the Plant Site with a maximum daily throughput equal to one-half the rate at the previous WWTF. The throughput rate at the WWTF accounted for both the waste water treatment related lime demand and other lime demands at the Mine Site, but in the modified design these two activities would be split between the Plant Site WWTS and the Mine Site. Total potential Project emissions from lime storage and handling will remain unchanged.
- Reduction in actual truck traffic between the Mine Site and Plant Site – resulting in lower air emissions for the Project.
- The emergency power requirements at the WWTS can be met by the WWTP generator in the current emission inventory, as critical power demand is only indirectly related to building size. Emergency power demand is driven by the size of pumps and other energy intensive equipment that must continue to operate during a power failure.

PolyMet proposes to retain the following sources in the air emissions inventory:

- The lime storage and handling equipment at the WWTF (identified as EU 147, SV 50 and EU 148 in the air permit application) was sized to accommodate the WWTF lime demand along with other neutralization needs at the Mine Site. A lime silo and mix tank would remain in the Mine Site emission inventory, with a maximum daily throughput equal to one-half the previous rate, to

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account for potential future lime demand if powdered lime would be preferred or required for other Mine Site neutralization needs. The lime storage and handling will be included in the initial air permit for the Project. The date of commencement of construction for this equipment will be dependent on the specific demand that indicates the need for powdered lime at the Mine Site and the Project timeline associated with this demand. All applicable provisions of the air permit and state and federal air quality regulations will be followed when the equipment is installed.

- Truck traffic between the Plant and Mine sites previously associated with waste water treatment would remain unchanged in the emissions inventory, which accounts for variation in operation over the mine life.

The lime storage and handling equipment proposed for relocation to the Plant Site has controlled potential PM<sub>2.5</sub> emissions of about 0.6 tons per year compared to the current controlled potential PM<sub>2.5</sub> emissions at the Plant Site of 194.3 tons per year. The WWTS is also located away from the “effective fenceline” (i.e., nearest point to the emission sources where ambient air impacts are evaluated) and is unlikely to influence the stacks located in the Crusher/Concentrator and Hydrometallurgical Plant. Therefore, effects on the Plant Site modeling due to the WWTS changes would be minimal.

Truck traffic associated with hauling of WWTF filtered sludge from the WWTF to the Plant Site for disposal (either offsite, in the HRF once constructed, or into the autoclave for processing once constructed) would be eliminated as a result of this modification. Lime might still be needed at the Mine Site. One option for delivering lime to the Mine Site would be hauling slurry by truck from the Plant Site. The current Plant Site and Mine Site emission inventories have 18, 40-ton trucks per day hauling lime and sludge between the Mine Site and the Plant Site. This number of trips would allow sufficient lime movement to accommodate potential lime needs at the Mine Site and would remain in the emission inventory for future design flexibility over the 20-year mine life.

The relocated ponds at the Mine Site would have minimal effect on air permitting because the new location is within the proposed “effective fenceline” outside of which ambient air impacts are to be evaluated, and there would be no emission-generating activity associated with the ponds. Potential PM<sub>10</sub> monitoring locations as discussed with MPCA as part of a planned revision to the draft Special Purpose Monitoring Plan would need to be reevaluated considering the location of the ponds, but submittal of an updated plan was already intended based on additional modeling to be completed in connection with the Project's air permit application.

The emissions inventory for the air permit application would need to be updated to reflect the relocation of some sources as described above and changes to the building configurations. WWTS chemical usage with the potential to generate emissions (e.g., dust from handling) would be included in the Plant Site emission inventory. Work on a Class II modeling supplement and AERA verification runs is already underway to address a request from MPCA and an error in a portion of the AERMOD air dispersion

## WaterLegacy Letter USACE (6-29-2017), Attachment I

**To:** Ann Foss, Minnesota Pollution Control Agency; Jess Richards, Minnesota Department of Natural Resources; Kenton Spading, U.S. Army Corps of Engineers

**Prepared for:** Poly Met Mining, Inc. (PolyMet)

**From:** Don E. Richard, PhD, P.E.

**Subject:** Proposed Waste Water Treatment System (WWTS) Relocations (Version 3)

**Date:** April 11, 2017

**Page:** 12

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modeling system issued by USEPA. The emission inventory, updated to accommodate the WWTS modification discussed in this memo, would be used in the additional modeling to be conducted. The proposed changes are minor in the context of the Class I modeling, so updated Class I modeling is not proposed.

### 3.3 Wetlands

The WWTS relocations would result in no changes to wetland impacts at the Plant Site, as shown on Large Figure 11 or along the Transportation and Utility Corridors.

With the WWTS relocations at the Mine Site, wetland impacts would decrease by 7.9 acres, including 7.8 acres of direct impact and 0.1 acres of indirect impact (fragmentation)<sup>2</sup>. Wetland impacts would be reduced by 0.3 acres in open bog (Wetland 47; direct impact<sup>3</sup>), by 0.4 acres in coniferous swamp (Wetland 48A; direct impact), and by 7.6 acres (7.5 acres of direct impact and 0.1 acre of indirect (fragment impact)) in coniferous bog (Wetlands 80, 86, 88, and 104). Based on the factors for potential indirect wetland impacts, as identified in the Wetland Data Package (Reference (3)), these wetlands would have a Rating of either 1 or 2 (one or two factors potentially indirectly impacting a wetland). The bog wetlands have a rating of 1 and the coniferous swamp has a rating of 2. Based on these ratings, no changes are planned for the Monitoring Plan for Potential Indirect Wetland Impacts (Reference (4)).

Large Figure 12 compares the wetland area impacts for the WWTS relocations to those that were included in the FEIS, Section 404 permit application, Permit to Mine application, and WCA permit application. The NorthMet Project Wetland Replacement Plan and Wetland Permit Application include the mitigation proposed for the 7.9 acres of wetland impact for the FEIS/permit application location. The wetland impacts planned in the FEIS and permit applications would include open bog, coniferous swamp, and coniferous bog. Mitigation requirements were dependent on the acreage of each type of wetland impacted. This reduction in required mitigation would be accounted for as appropriate under the applicable regulatory processes governing federal and state wetland and water permits.

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<sup>2</sup> Large Table 2 of the Wetland Replacement Plan v1 (Oct 2016) identifies a total of 758.2 acres of direct impact for the Mine Site. The proposed WWTS relocations would decrease the direct wetland impacts by 7.8 acres. The total direct wetland impact for the Mine Site with the proposed WWTS relocations would be 750.4 acres. Large Table 2 of the Wetland Replacement Plan v1 (Oct 2016) identifies a total of 26.4 acres of indirect (fragmented) wetland impact for the Mine Site. The proposed WWTS relocations would decrease the indirect (fragmented) wetland impacts by 0.1 acres. The total direct wetland impact for the Mine Site with the proposed WWTS relocations would be 26.3 acres.

<sup>3</sup> Wetland 47 is classified as an open bog, which means its hydrology is supported by precipitation and not dependent on the size of the watershed. Therefore, the remaining portion of Wetland 47 would not be considered as fragmented. Factors that may cause potential indirect impacts to Wetland 47 include metals (this factor applies to all wetlands in this revised area, see response to Comment 0019) which would result in a Rating of 1 (one factor potentially indirectly impacting the wetland).

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**Prepared for:** Poly Met Mining, Inc. (PolyMet)  
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**Subject:** Proposed Waste Water Treatment System (WWTS) Relocations (Version 3)  
**Date:** April 11, 2017  
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The wetlands that are located within the area of the original WWTF location were considered to be either directly impacted or indirectly impacted (identified as impacted by fragmentation) as part of the wetland impacts analysis for the FEIS and permit applications.

Within the proposed Equalization Basin Area, there are no wetlands<sup>4</sup>. This upland area is forested as is the area of the original location of the WWTF. These areas are approximately the same acreage, so there should not be any modification needed to the Biological Opinion, which required the USACE to consult with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 *et seq.*

### 3.4 Cultural Resources

Cultural resources surveys have already been conducted within the Equalization Basin Area. The eastern half of the Equalization Basin Area was surveyed in 1990 for the U.S. Forest Service Stubble Creek Timber Sale. The entire Equalization Basin Area was surveyed as part of a 2004 survey conducted by The 106 Group, which resulted in a “no effect” report (Reference (5)). All but the southern edge of the Equalization Basin Area was surveyed in 2006 and 2008 by Soils Consulting (Reference (6); Reference (7)). Therefore, this area has been surveyed for cultural resources by three different cultural resource teams between 1990 and 2008. Additionally, the Project has completed its NHPA Section 106 review process, resulting in a Memorandum of Agreement to resolve adverse effects on eligible historic properties in the Project area. As a result of these studies and coordination, no additional cultural resources work is needed within this area.

## 4.0 Permitting Effects

It is envisioned that updates to the air permit application, NPDES/SDS permit application, the consolidated Water Appropriation Permits application, and the Permit to Mine application would need to be provided to the MPCA and the DNR to accurately reflect the WWTS relocations. Based on the environmental effects of the WWTS relocations described in Section 3, descriptions of environmental effects would not need updating. Rather, the changes would principally affect application terminology and descriptions, along with associated supporting information, such as figures and permit application support drawings.

### 4.1 NPDES/SDS Permit Application Updates

The items that would need to be updated in the NPDES/SDS permit application include:

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<sup>4</sup> There are wetlands to the south of the proposed WWTS pond relocations. These wetlands have already been identified with a factor rated low to high likelihood of hydrologic impacts (which may be due to changes in watershed). Large Figure 23 in the Wetland Data Package v11 (Apr 2015) identifies these wetlands with Ratings ranging from 1 to 4. There are currently multiple wetland hydrology monitoring wells located in these wetlands; therefore, no changes are planned for the Monitoring Plan for Potential Indirect Wetland Impacts v1 (Feb 2016).

**WaterLegacy Letter USACE (6-29-2017), Attachment I**

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**Date:** April 11, 2017

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- Descriptions and figures of the WWTS, including a review of the constructability of the ponds at the new location
- Proposed Monitoring Plan (due to the closure of a groundwater well)
- Permit Application Support Drawings for the WWTS (replacing the drawing sets for the WWTF and WWTP)
- Permit application forms (e.g., Municipal and Industrial Pond Attachments)
- Waste water treatment chemical additives information, to reflect that most usage would be at the Plant Site.

## **4.2 Permit to Mine Application Updates**

The portions of the Permit to Mine application that would need to be updated include:

- Description of the WWTS system layout
- Mine Site engineering drawings for mine water piping to the new location of the Construction Mine Water Basin and equalization basins
- Mine Site, Transportation and Utility Corridors, and Plant Site drawings for the Mine to Plant Pipelines from the equalization basins to the WWTS and the Construction Mine Water Basin to the FTB Pond
- Financial assurance calculations, to reflect the proposed WWTS relocations

## **4.3 Water Appropriation Permits Application Updates**

The portions of the consolidated Water Appropriation Permit application that would need to be updated include:

- Dewatering appropriation quantities associated with construction of the WWTS equalization basins and the Construction Mine Water Basin
- Description of the WWTS system layout
- Permit Application Support Drawings for the WWTS (replacing the drawing sets for the WWTF and WWTP)

## **4.4 Air Quality Permit Application Updates**

In addition to the changes described in Section 3.2 to the emission inventory and model inputs, the proposed changes to the WWTS would require updates to the facility description portion of the air permit application, including equipment lists, process flow diagrams, and site layout figures. The PolyMet air

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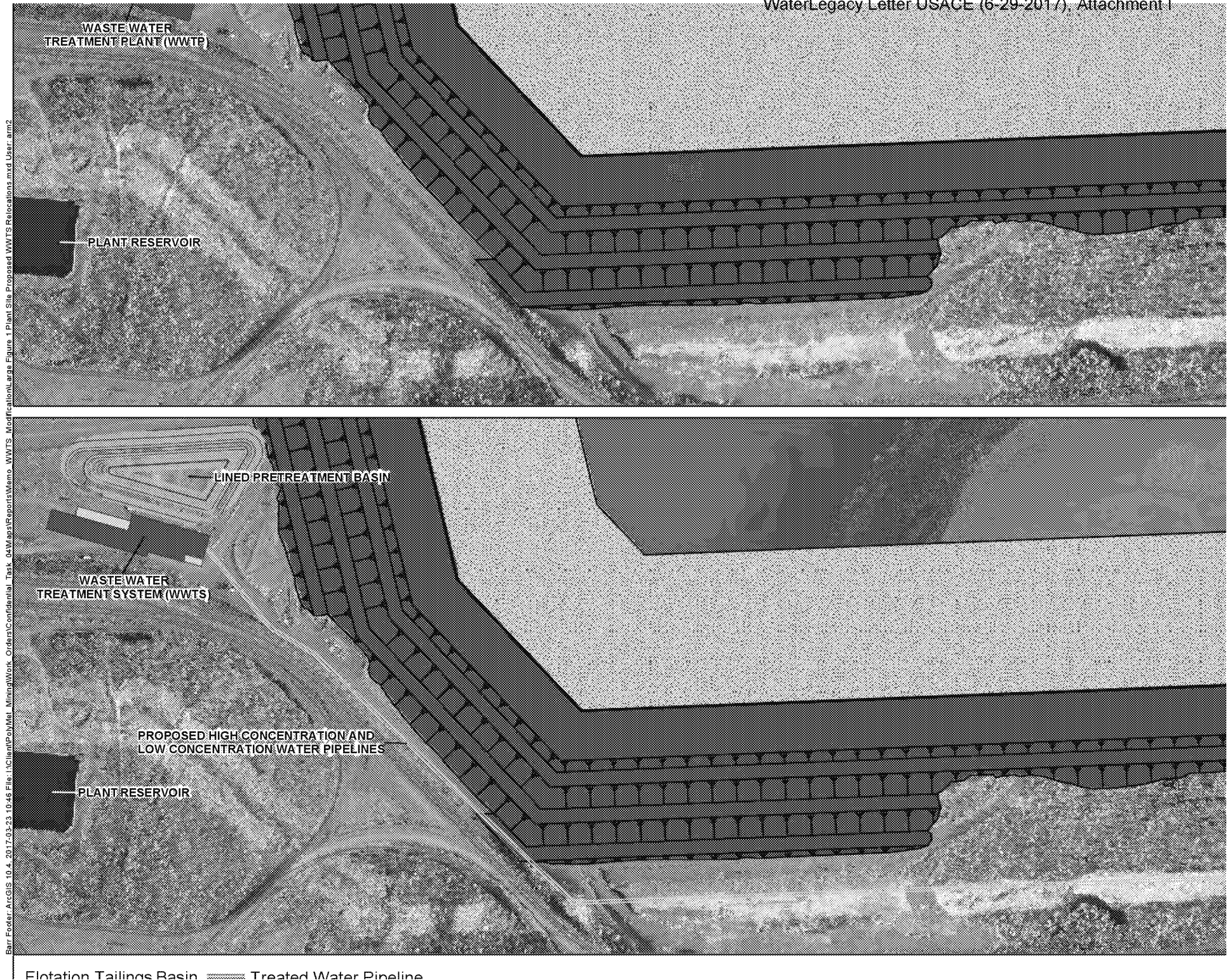
permitting team would work with MPCA staff to determine the most efficient way to accomplish the changes. For example, relocated emission units could either be renamed or assigned new ID numbers, whichever was more efficient for data entry into the MPCA's TEMPO system.

## **4.5 Wetland Permit Updates**

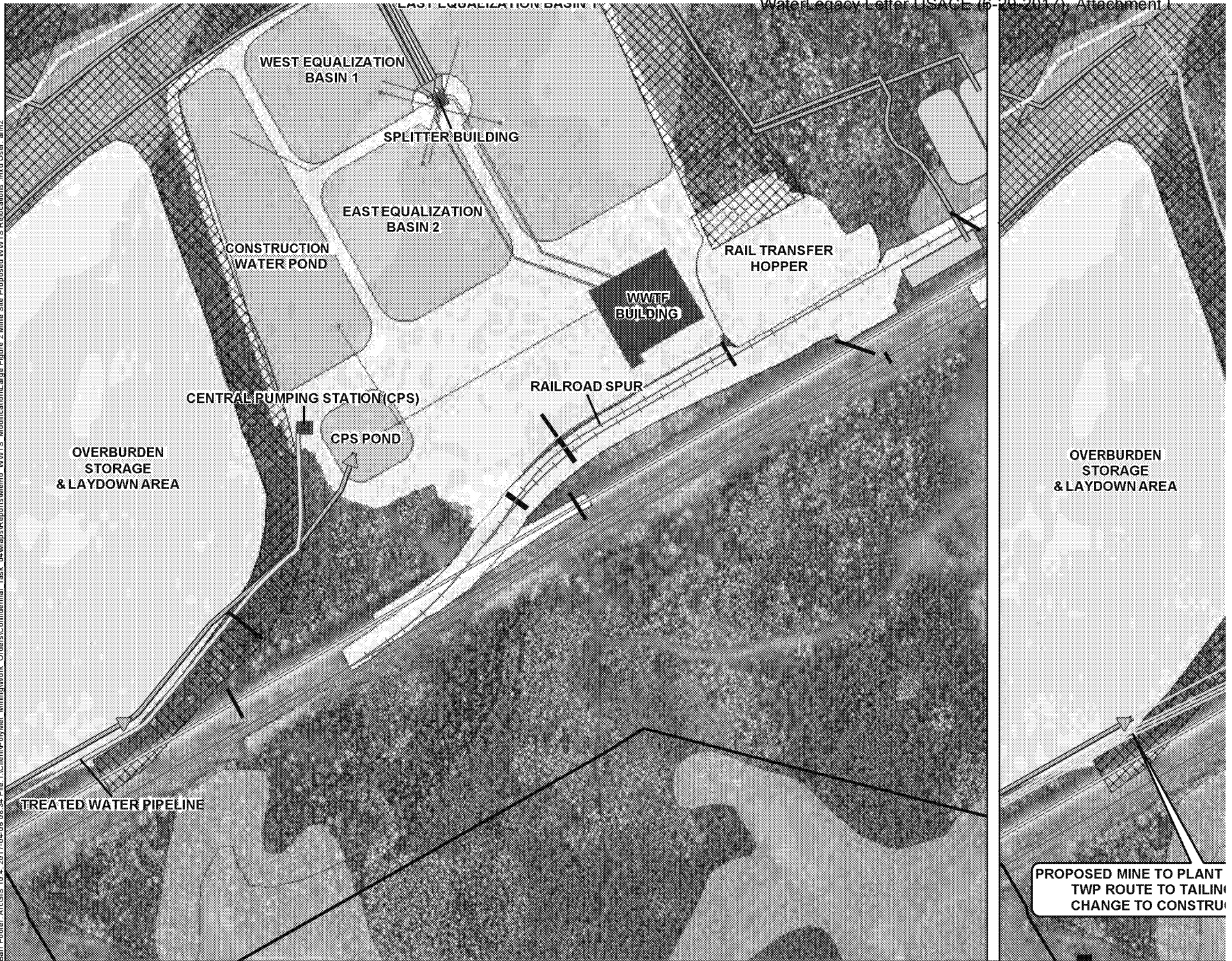
The Section 401 water quality certification, the Section 404 permit application, and the Wetland Conservation Act approval would be affected by this Project change. PolyMet will work with these permitting teams to address any needed changes associated with each process.

## **5.0 References**

1. **Minnesota Department of Natural Resources, U.S. Army Corps of Engineers and U.S. Forest Service.** Final Environmental Impact Statement: NorthMet Mining Project and Land Exchange. November 2015.
2. **Barr Engineering Co.** Waste Water Treatment Systems: Design and Operation Report - NorthMet Project v1. July 2016.
3. **Poly Met Mining Inc.** NorthMet Project Wetland Data Package (v11). April 2015.
4. —. Monitoring Plan for Potential Indirect Wetland Impacts (v1). February 2016.
5. **The 106 Group.** Cultural Resources Assessment for the Environmental Impact Statement Scoping Document, PolyMet Mining Corporation NorthMet Project, Hoyt Lakes, St. Louis County, Minnesota. Report prepared for Barr Engineering Company. 2004.
6. **Soils Consulting.** Phase I Archaeological Survey, NorthMet Mine Impact Area. 2006.
7. —. Phase I Archaeological Survey of Dunka Road Expansion and Substation – and – Phase II Archaeological Evaluation of NorthMet Archaeological Site. 2008.



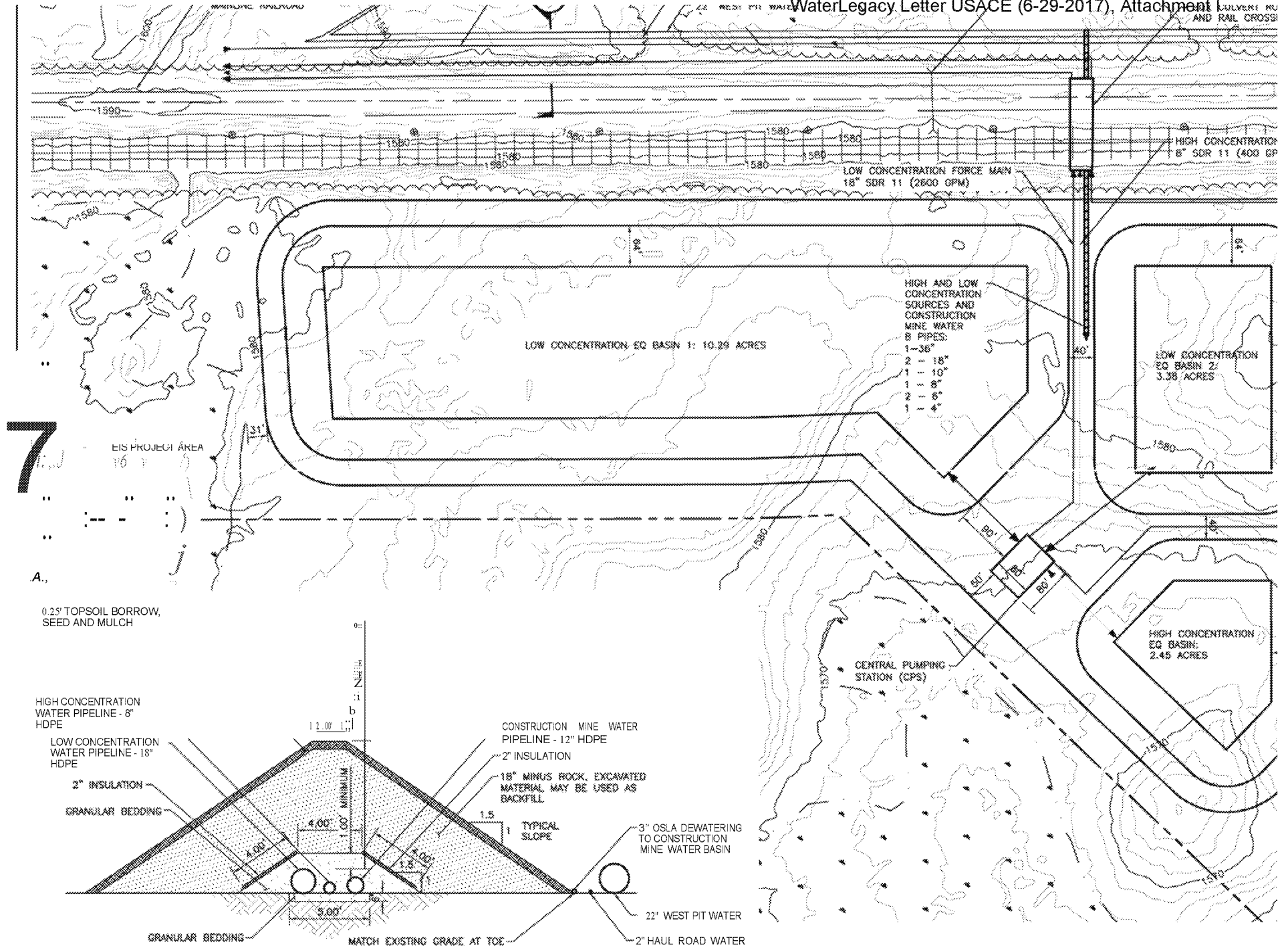
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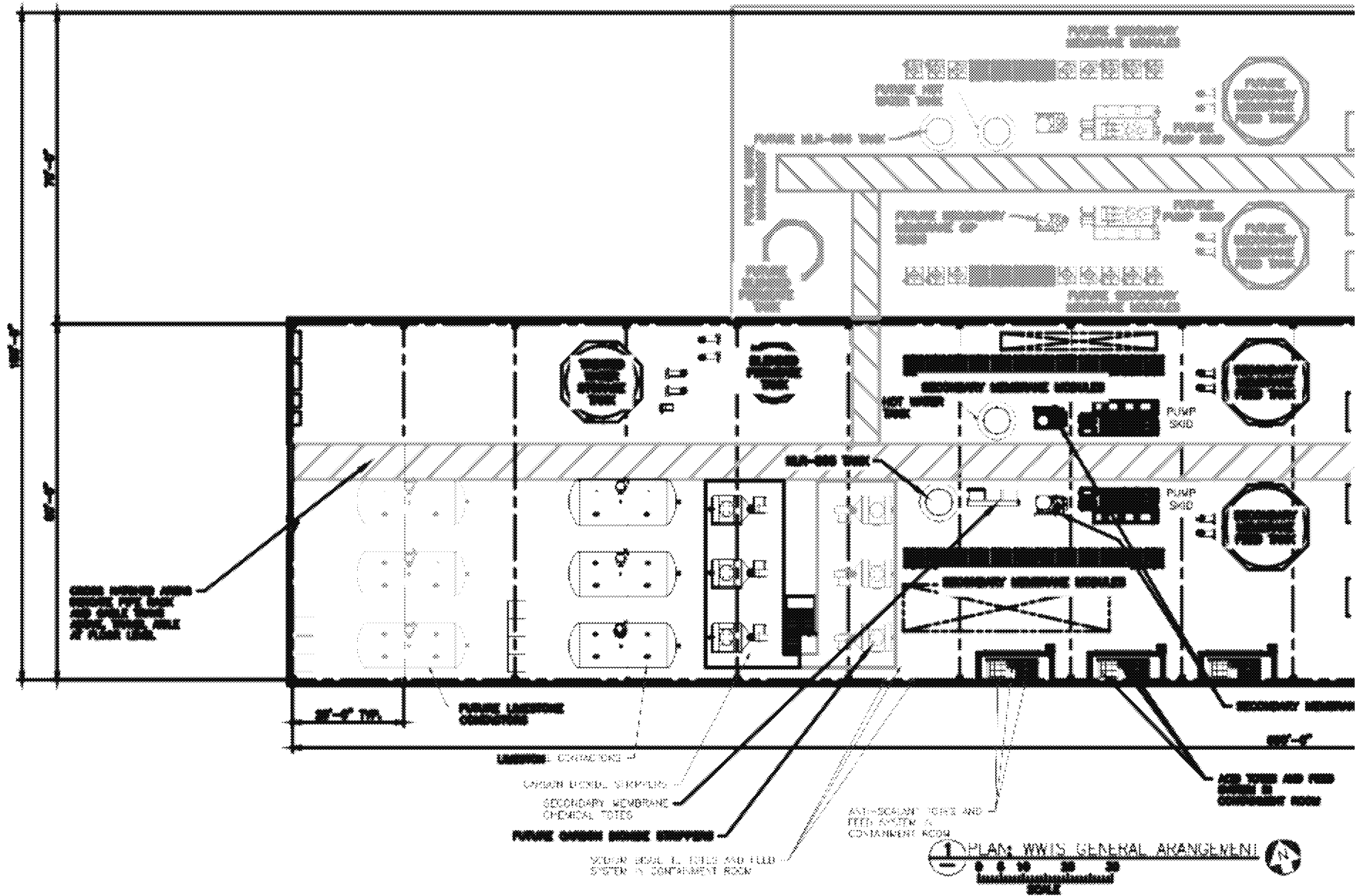
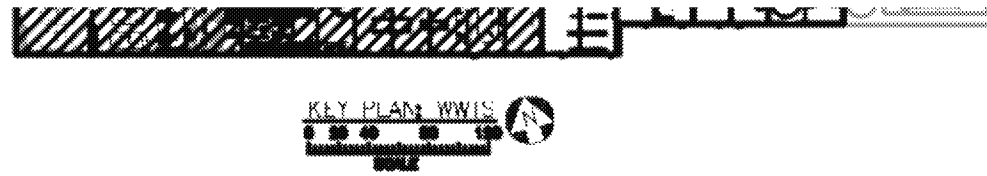


EIS Project Areas

Treated Water Pipeline

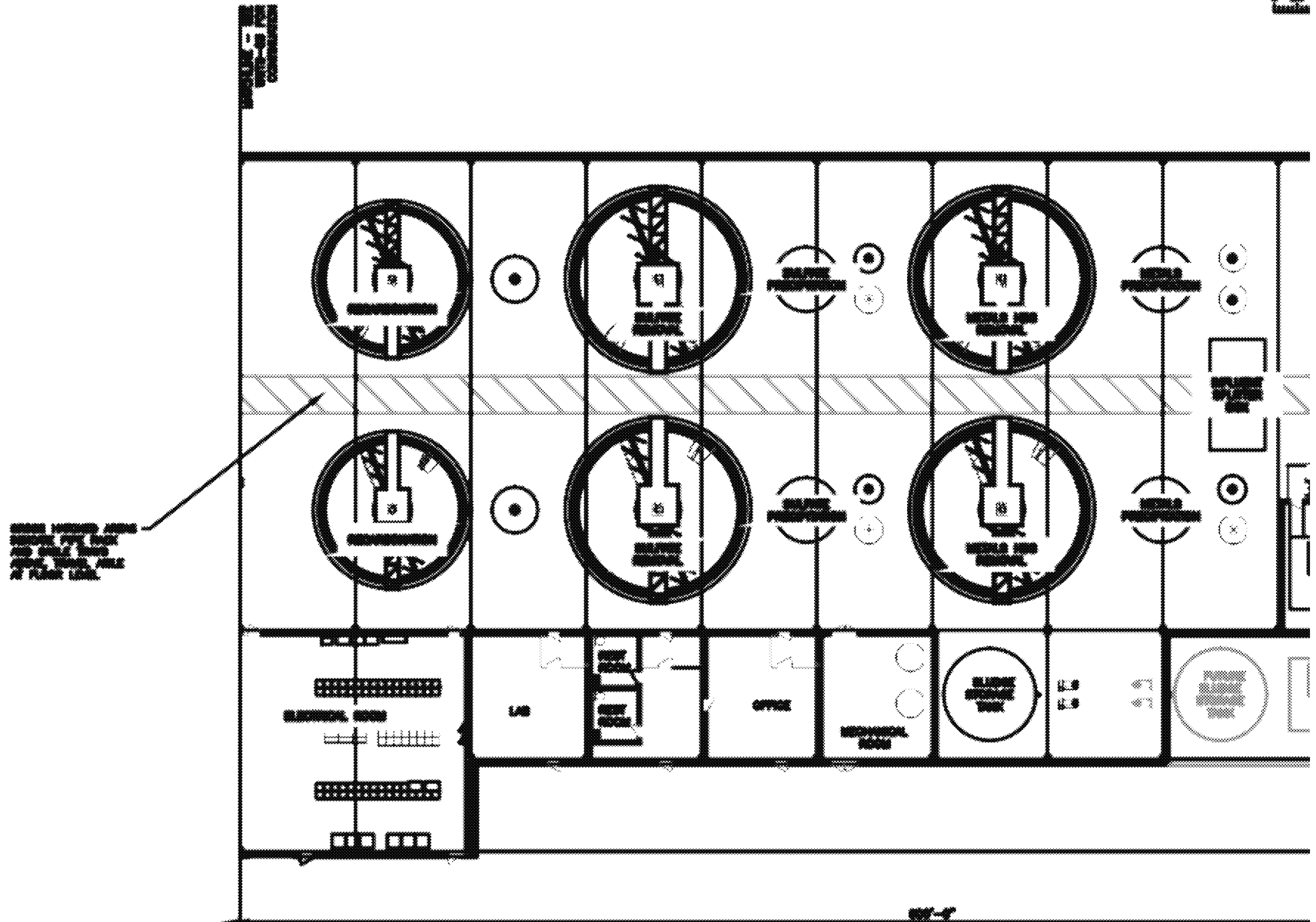
PROPOSED MINE TO PLANT  
TWP ROUTE TO TAILING  
CHANGE TO CONSTRU

**G) SECTION: TYPICAL PIPELINE CONSTRUCTION**0 2 4 6 8 10  
SCALE IN FEETPLAN: PROPOSED  
0 10 20 30 40 50 60 70 80 90 100  
SCALE





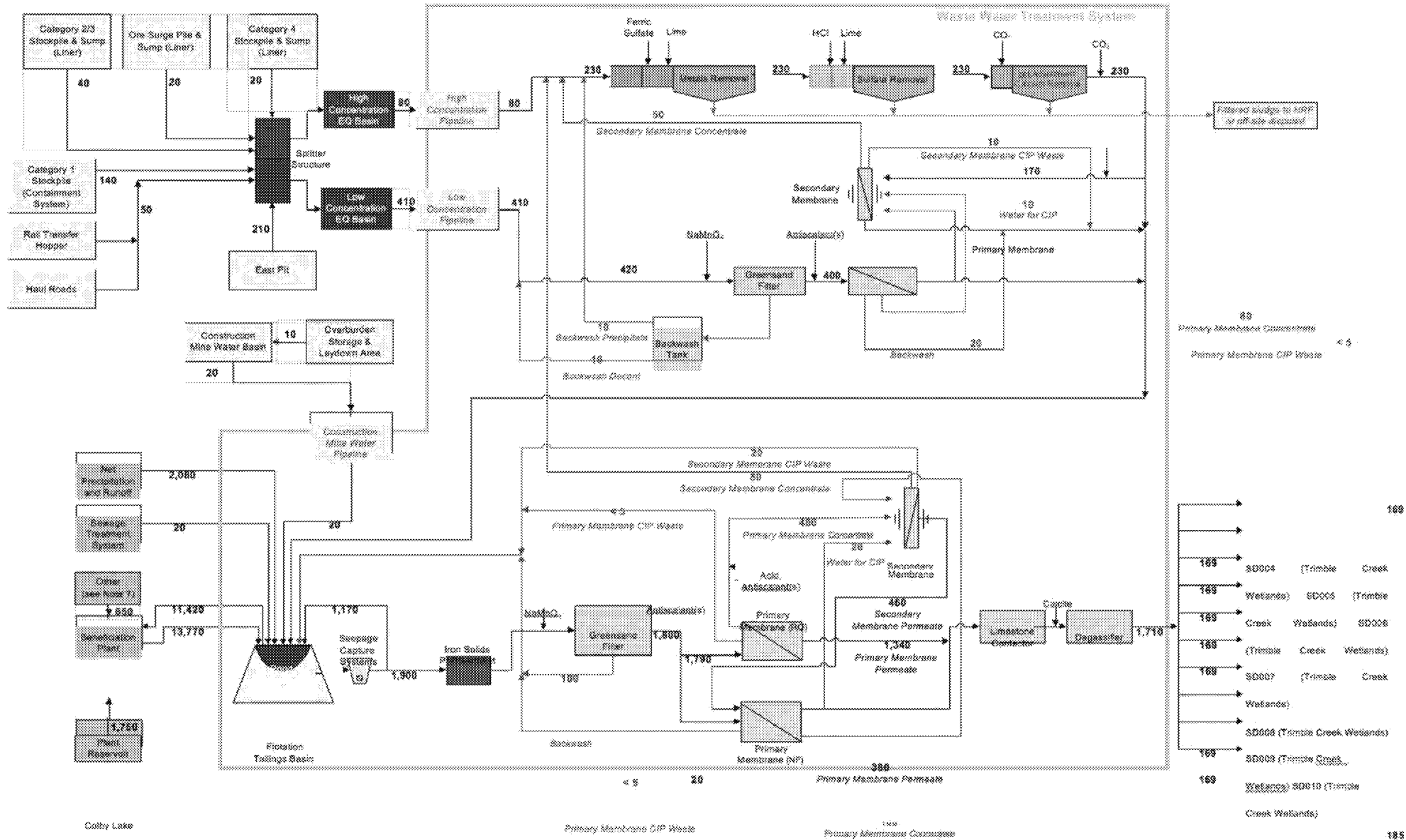
KEY



1 PLAN WWIS GENERAL ARRANGEMENT

## WaterLegacy Letter USACE (6-29-2017), Attachment I

Figure 1: Process Flow Diagram (PFD) of the Waste Water Treatment System (WWTSS) at the Colby Lake Mine. The diagram shows the flow of water from various sources through treatment processes to discharge points.



Legend	
XX	P50 Annual average flow (rounded to 10 gpm)
	P50 Annual average flow

## Notes:

- (1) This figure shows the Waste Water Treatment System flow configuration at the beginning of operations. Mine Year 1 is expected to be the year of minimal discharge and minimal loading from the WWTSS.
- (2) This figure shows average flows from sources of mobile water, operations contributing wastewater to the system, and treatment units within the WWTSS. It does not include flows that do not contribute to the effluent, such as water consumed within tailings and water in storage from chemical precipitation units. Total flows may not equal the sum of their contributing parts because flows that do not contribute to the effluent are not shown and flows are rounded to the nearest 10 gpm.
- (3) Flows are based on the Colby Lake water model (Water Modeling Data Package - Mine Site V14 and Water Modeling Data Package - Plant Site V11).

effluent, and treatment units within the WWTSS. It does not include flows that do not contribute to the effluent, such as water consumed within tailings and water in storage from chemical precipitation units. Total flows may not equal the sum of their contributing parts because flows that do not contribute to the effluent are not shown and flows are rounded to the nearest 10 gpm.

(3) Flows are based on the Colby Lake water model (Water Modeling Data Package - Mine Site V14 and Water Modeling Data Package - Plant Site V11).

WaterLegacy Letter USACE (6-29-2017), Attachment I

(4) Consistent with the FERC, average flows outside the WWTS are the actual average of the monthly mean flow rates.

(5) WWTS inflow flows were estimated using the FERC ~~assessments~~ model (Waste Water Treatment System Design and Operation Report v1). For the diagram, the ~~assessments~~ model inflow values to the WWTS were the annual average of the monthly mean values from the ~~assessments~~ model flow data over eight (8) years.

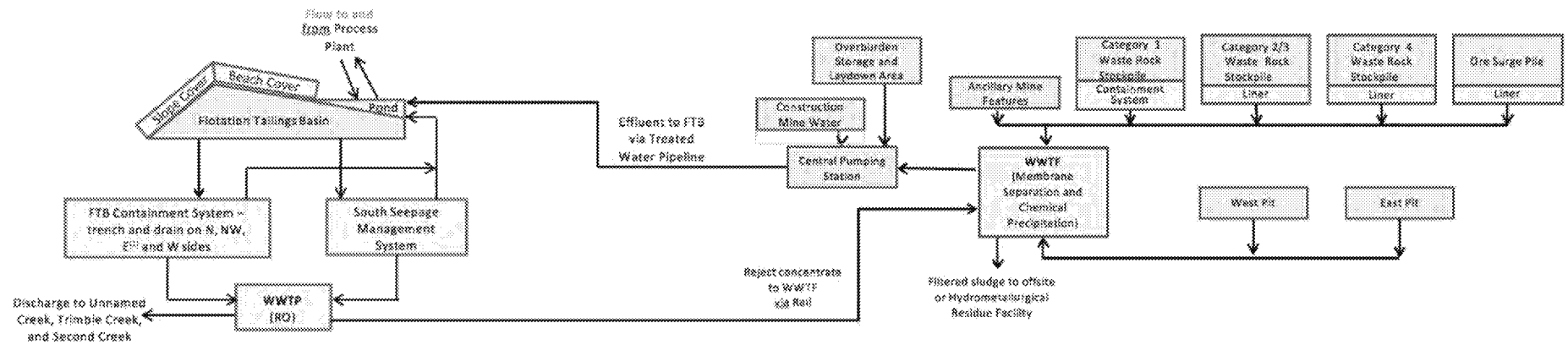
(6) To the maximum and the values reported in the FERC ~~assessments~~ report consistent with EPA Form 20, the values to the surface water discharge facility were not rounded to 10 gpm.

(7) Other values to the Reservoir Flow include water in the low flow, seepage, and ground water at every point.

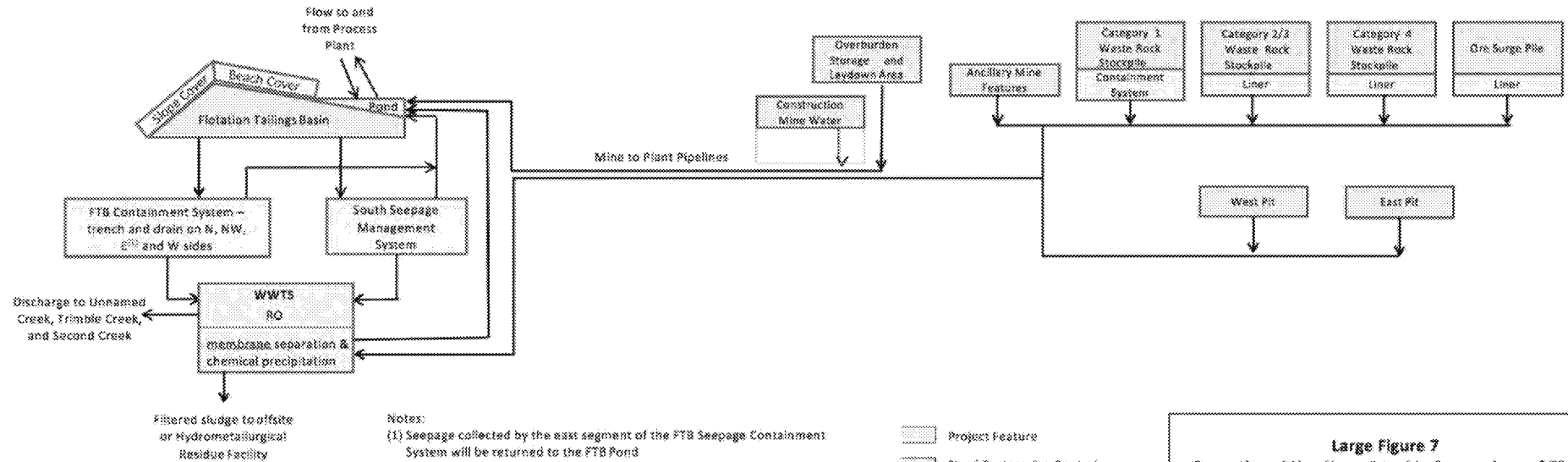
WATER TREATMENT AVERAGE FLOWS OVERALL FLOW SHEET – MINE YEAR 1 NorthMet Project Poly Met Mining Inc.
Large Figure 6 Proposed Waste Water Treatment System (WWTS) Relocations

Operations: Mine Years 1 to 11

Configuration with WWTP and WWTF Evaluated for FEIS



Proposed WWTS Relocations



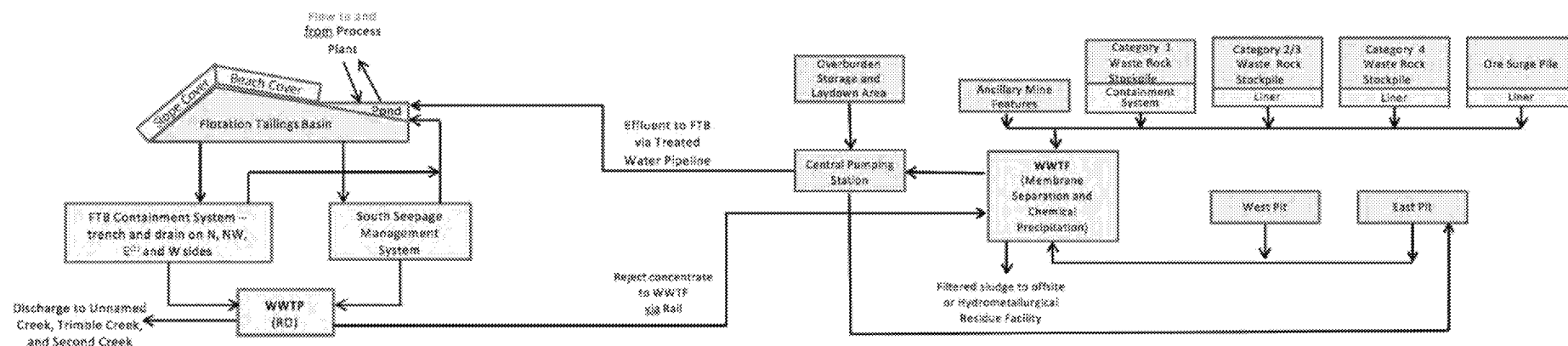
Notes:  
 (1) Seepage collected by the east segment of the FTB Seepage Containment System will be returned to the FTB Pond

- Project Feature
- Fixed Engineering Control
- Adaptive Engineering Control

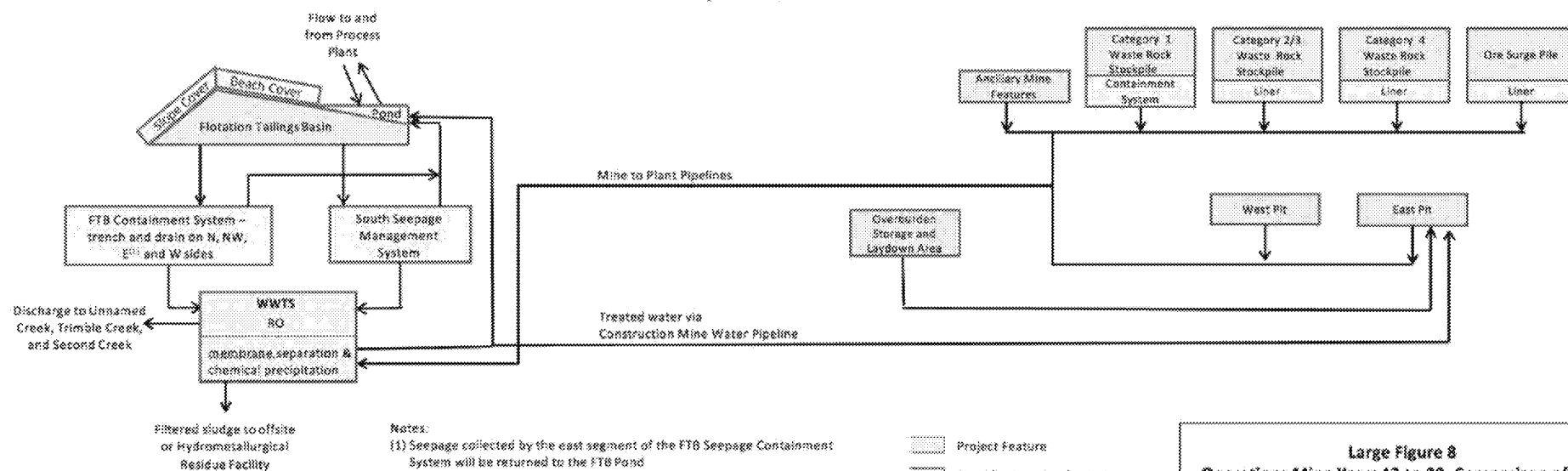
**Large Figure 7**  
**Operations Mine Years 1 to 11: Comparison of FEIS**  
**Flows and Proposed Flows with WWTS Relocations**

Operations: Mine Years 12 to 20 (East Pit Backfilling)

Configuration with WWTP and WWTF Evaluated for FEIS



Proposed WWTS Relocations

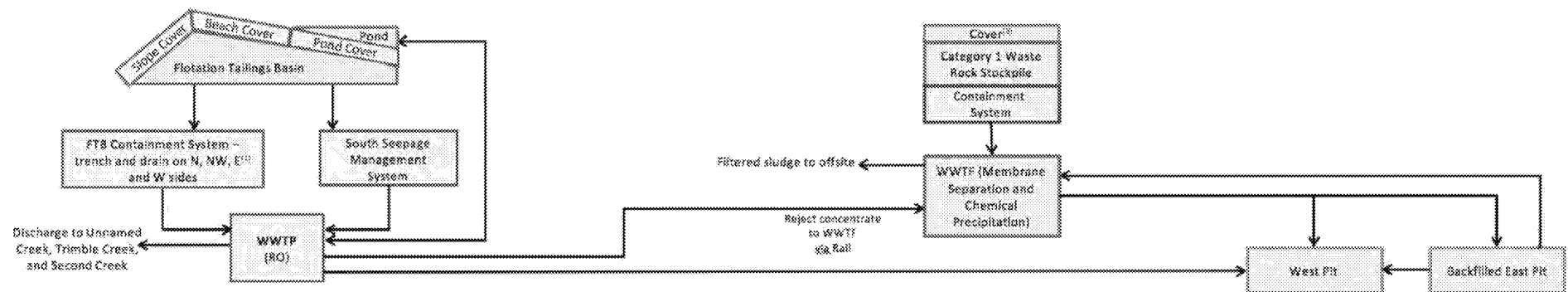


- Project Feature
- Fixed Engineering Control
- Adaptive Engineering Control

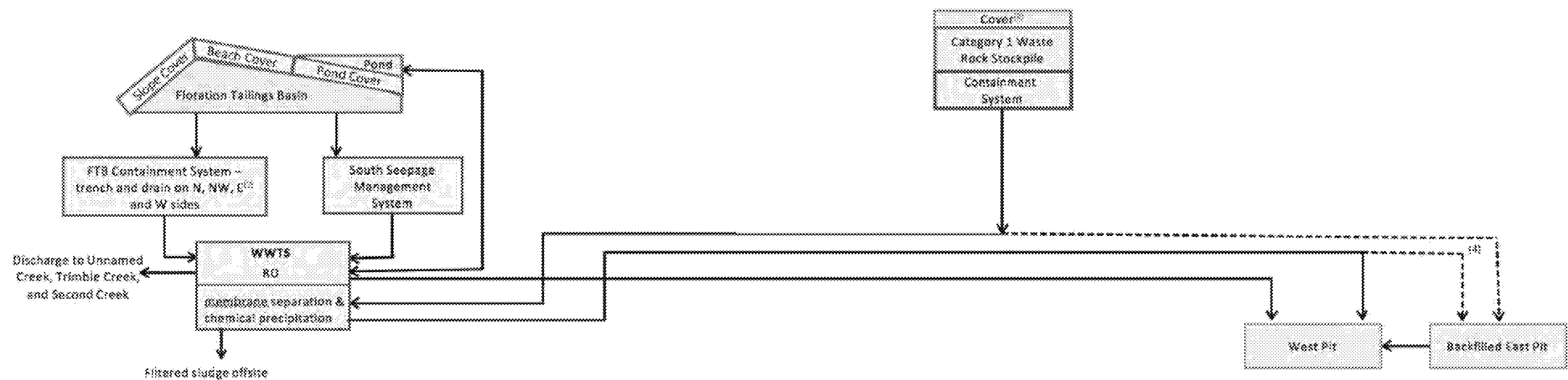
**Large Figure 8**  
Operations Mine Years 12 to 20: Comparison of FEIS  
Flows and Proposed Flows with WWTS Relocations

Reclamation<sup>(1)</sup>

## Configuration with WWTP and WWTF Evaluated for FEIS

Reclamation and Closure<sup>(1)</sup>

## Proposed WWTS Relocations

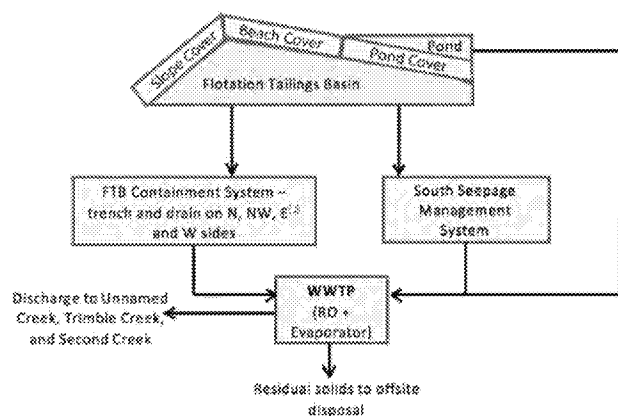


## Notes:

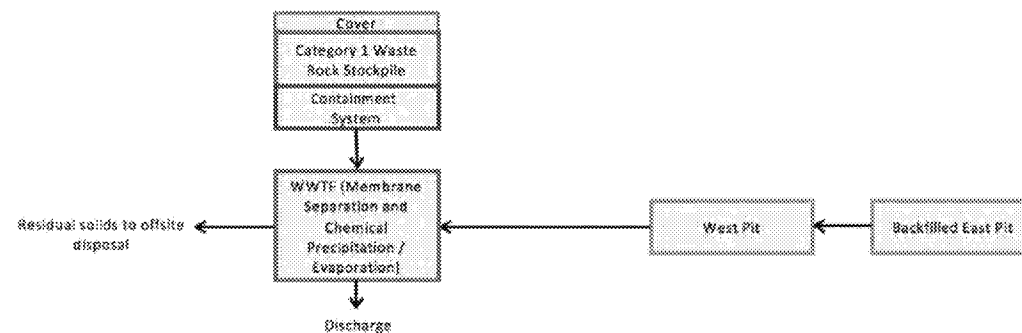
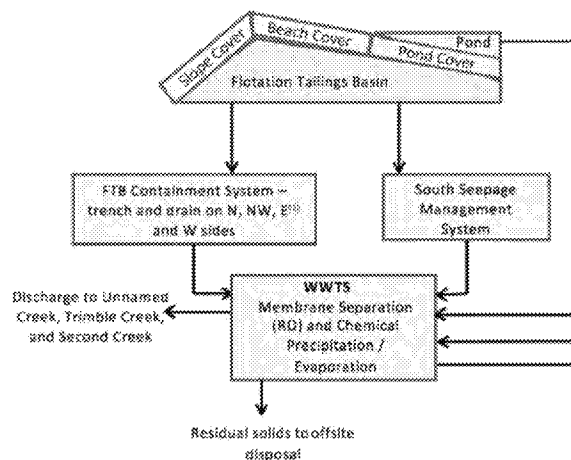
- (1) The Project phase referred to as "reclamation" in the FEIS encompasses the phases referred to as "reclamation" and "closure" in the Permit to Mine
- (2) Seepage collected by the east segment of the FTB Seepage Containment System will be returned to the FTB Pond
- (3) Category 1 Waste Rock Stockpile covering begins in Year 14 and is completed by Year 21
- (4) After East Pit flushing is completed (at the end of reclamation) these flows will be discontinued

- Project Feature
- Fixed Engineering Control
- Adaptive Engineering Control

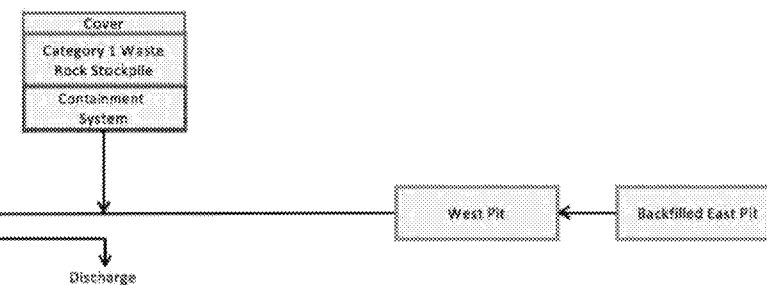
**Large Figure 9**  
**Reclamation and Closure: Comparison of FEIS Flows**  
**and Proposed Flows with WWTS Relocations**

Long-Term Closure<sup>(1)</sup>

## Configuration with WWTP and WWTF Evaluated for FEIS

Postclosure Maintenance<sup>(1)</sup>

## Proposed WWTS Relocations



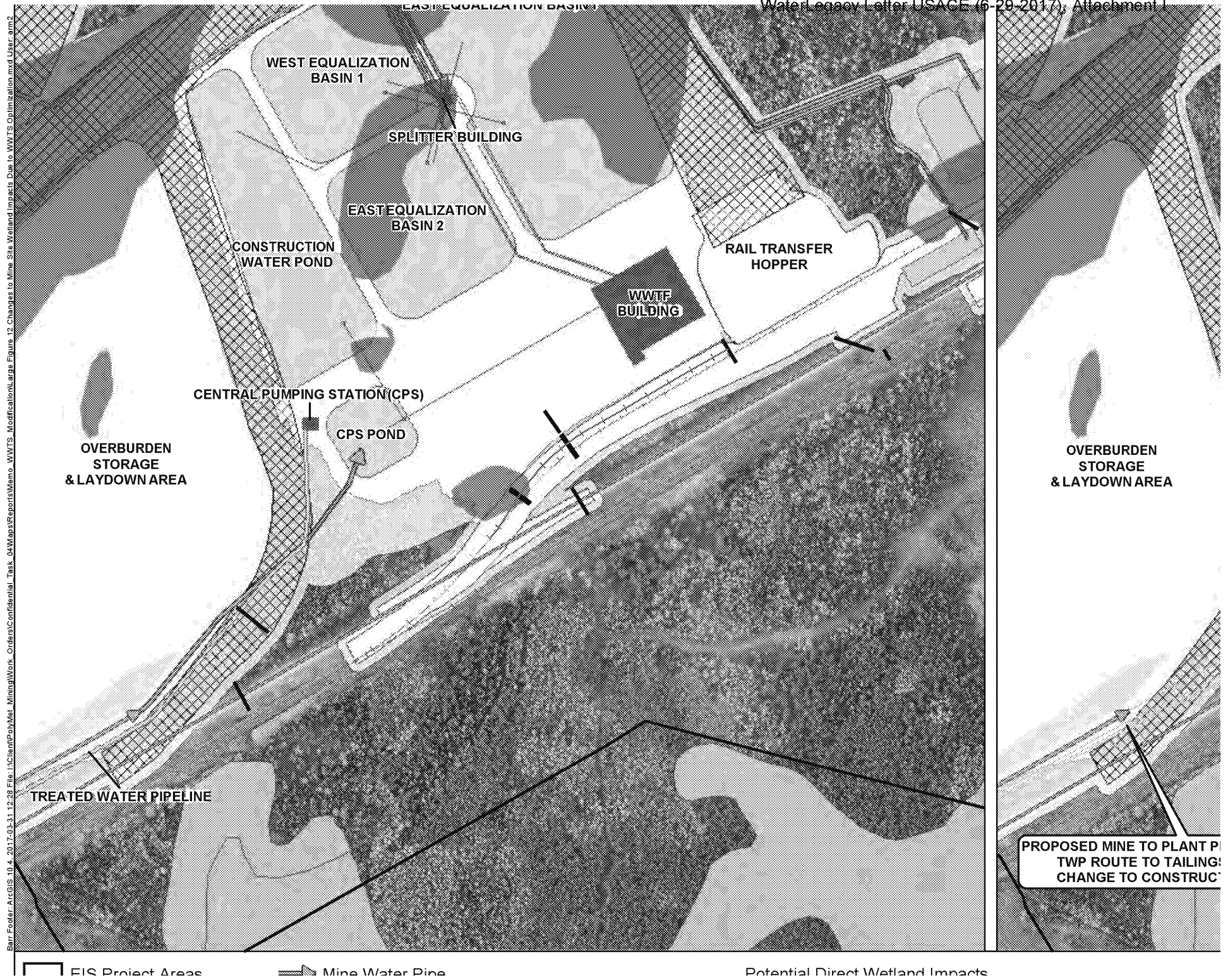
## Notes:

- (1) The Project phase referred to as "long-term closure" in the FEIS is referred to as "postclosure maintenance" in the Permit to Mine.  
 (2) Seepage collected by the east segment of the FTB Seepage Containment System will be returned to the FTB Pond.

- Project Feature  
 Fixed Engineering Control  
 Adaptive Engineering Control

**Large Figure 10**  
**Postclosure Maintenance: Comparison of FEIS Flows**  
**and Proposed Flows with WWTS Relocations**





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**Table 3-1 Summary of NorthMet Individual Permit Applications**

Individual Permit	Location	Activities Covered	Time Frame	Form Number
East Pit	Mine Site	<ul style="list-style-type: none"> <li>dewatering for overburden stripping</li> <li>pit dewatering</li> </ul>	Pre-operation construction phase to Mine Year 20	1
Central Pit	Mine Site	<ul style="list-style-type: none"> <li>dewatering for overburden stripping</li> <li>pit dewatering</li> </ul>	Operation phase (Mine Year 11 to 20)	2
West Pit	Mine Site	<ul style="list-style-type: none"> <li>dewatering for overburden stripping</li> <li>pit dewatering</li> </ul>	Operation phase (Mine Year 2 to 20)	3
Mine Site Infrastructure	Mine Site	<ul style="list-style-type: none"> <li>temporary construction dewatering</li> <li>Category 1 Stockpile Groundwater Containment System operation</li> <li>Stockpile underdrain operation (if needed)</li> <li>Collection of mine water and precipitation on stockpile liners and in lined ponds</li> </ul>	Pre-operation construction phase to Mine Year 20	4
Plant Site Infrastructure	Plant Site	<ul style="list-style-type: none"> <li>temporary construction dewatering</li> <li>Hydrometallurgical Residue Facility (HRF) wick drain operation (if needed)</li> <li>Collection of precipitation in the HRF and other lined and concrete ponds</li> </ul>	Pre-operation construction phase to Mine Year 20	5
Colby Lake	Plant Site	<ul style="list-style-type: none"> <li>withdrawal to supply make-up water to the Plant Site</li> </ul>	Pre-operation construction phase to Mine Year 20	6

### 3.1.2 Exempt Sources

Several Project water withdrawals will be exempt from water appropriation permitting requirements. As listed in Table 3-2, exempt sources involve test pumping of monitoring wells and collection of previously appropriated water.

## 5.0 Statement of Justification for Individual Permits

Dewatering is necessary for PolyMet to construct mining facilities, mine copper-nickel ore from open pits, and operate environmental controls. Withdrawal of water from Colby Lake is necessary for PolyMet to provide make-up water to the Plant Site (uses of make-up water are described in Section 3.0). The water appropriations proposed under the six Individual Permits are reasonable and practical, as detailed in the following subsections, and are necessary for the Project to provide the social and economic benefits documented in Section 5.2.10 of the FEIS (Reference (1)).

### 5.1 Overview and Pumping Schedule

PolyMet is applying for six Individual Permits: one permit for each of the three mine pits, one for construction and operation of Mine Site infrastructure, one for construction and operation of Plant Site infrastructure, and one for withdrawal of water from Colby Lake.

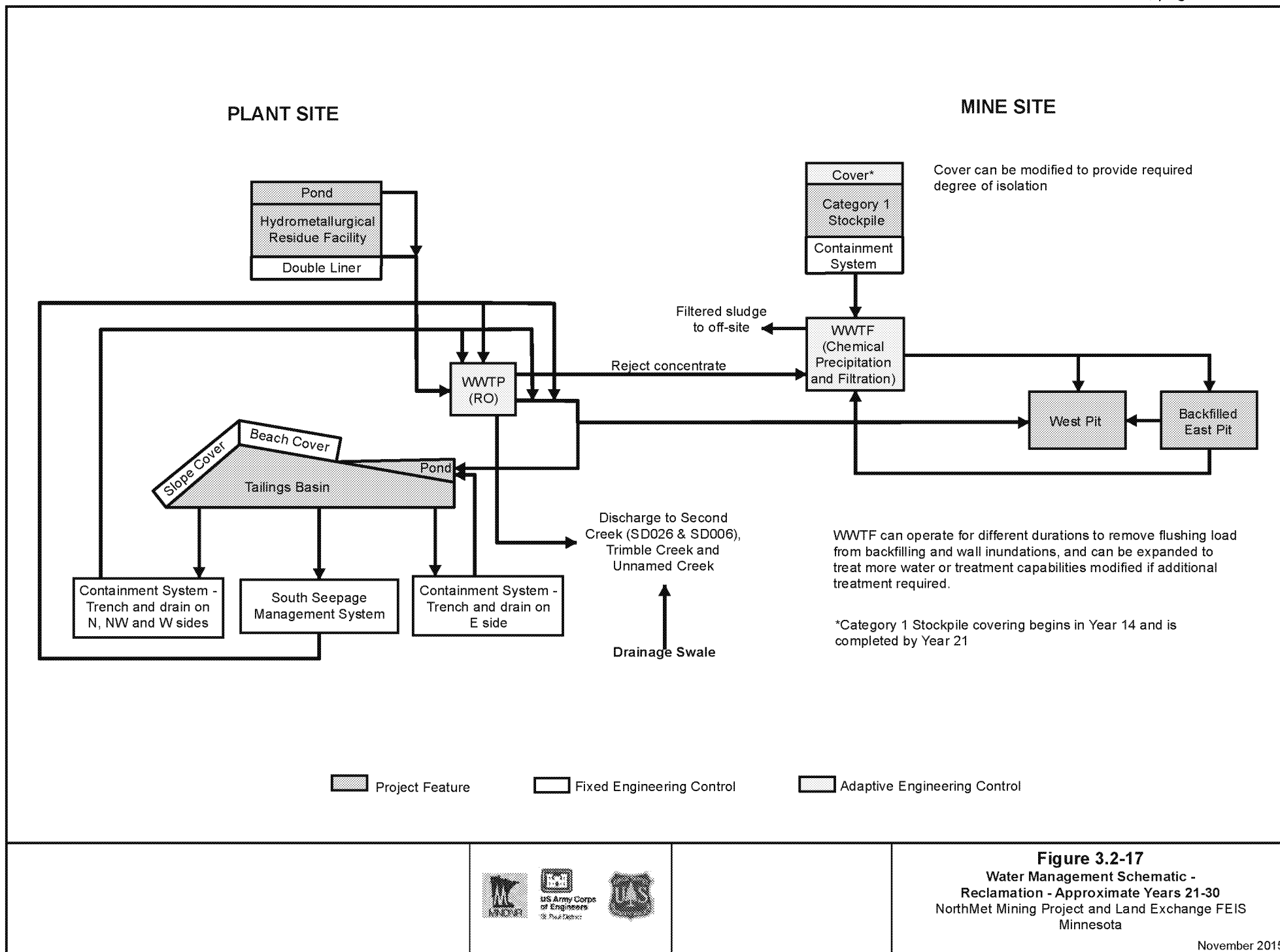
Table 5-1 provides an overview of the Individual Permit applications, the installations covered under each permit, and the schedule for pumping from each installation. The pumping schedule was estimated based on the Project schedule as detailed in the FEIS and the preliminary schedule for construction of Project infrastructure.

**Table 5-1 Individual Permit Application Overview**

Individual Permit	Installation	Pumping Schedule
East Pit	Overburden stripping	Pre-operation construction phase
	East Pit Sump	Mine Years 1 to 20
Central Pit	Overburden stripping	Mine Year 11
	Central Pit Sump	Mine Years 11 to 20
West Pit	Overburden stripping	Intermittent, Mine Years 2 to 11
	West Pit Sump 1 and Sump 2	Mine Years 2 to 20
Mine Site Infrastructure	Ore Surge Pile foundation, sumps, and overflow ponds construction	Pre-operation construction
	Construction of new buildings	Pre-operation construction
	Mine water pond construction	Intermittent, pre-operation construction to Mine Year 6
	Stormwater pond construction	Intermittent, pre-operation construction to Mine Year 2
	Category 4 Waste Rock Stockpile foundation, sumps, and overflow ponds construction	Intermittent, pre-operation construction and Mine Year 3
	Category 2/3 Waste Rock Stockpile foundation, sumps, and overflow ponds construction	Intermittent, pre-operation construction to Mine Year 6

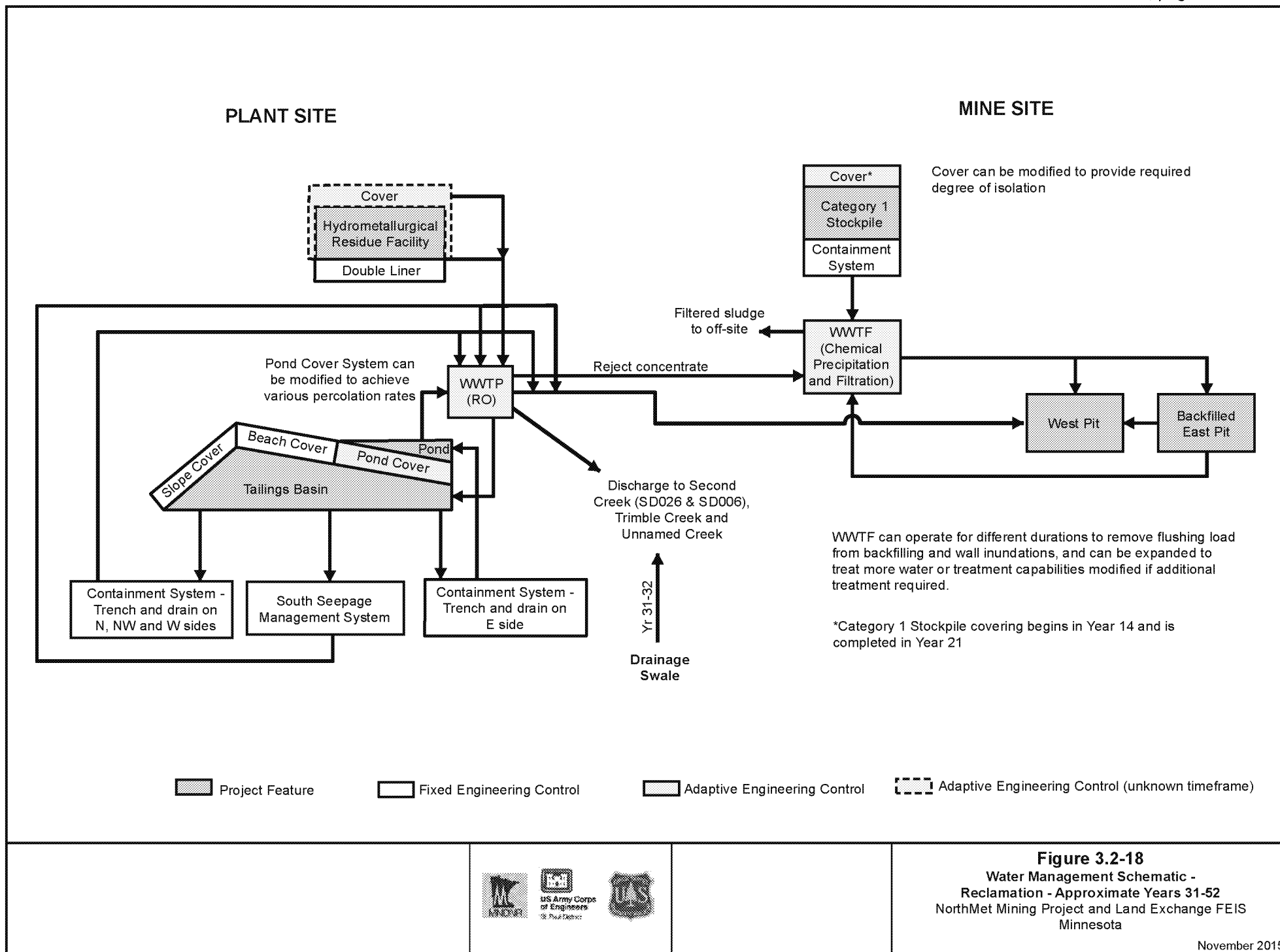
WaterLegacy Letter USACE (6-29-2017)  
Attachment J, page 3

Individual Permit	Installation	Pumping Schedule
Mine Site Infrastructure (cont.)	Category 1 Waste Rock Stockpile foundation construction	Intermittent, pre-operation construction to Mine Year 6
	Category 1 Stockpile Groundwater Containment System construction	Intermittent, pre-operation construction to Mine Year 5
	Category 1 Stockpile Groundwater Containment System operation	Mine Years 1 to 21
	Category 2/3 Waste Rock Stockpile liner mine water drainage (collected precipitation)	Mine Years 1 to 19
	Category 2/3 Waste Rock Stockpile underdrains, if needed	Mine Years 1 to 19
	Category 4 Waste Rock Stockpile liner mine water drainage (collected precipitation)	Mine Years 1 to 11
	Category 4 Waste Rock Stockpile underdrains, if needed	Mine Years 1 to 11
	Ore Surge Pile liner mine water drainage (collected precipitation)	Mine Years 1 to 20
	Ore Surge Pile underdrains, if needed	Mine Years 1 to 20
	Haul Roads, OSLA and RTH mine water runoff (collected runoff and precipitation)	Mine Years 1 to 20
	Lined ponds (Equalization Basins and Construction Mine Water Basin (collected precipitation))	Mine Years 1 to 20
	Miscellaneous construction dewatering	Intermittent, as needed
Plant Site Infrastructure	Flotation Tailings Basin (FTB) Seepage Containment System construction	Intermittent, pre-operations construction and Mine Year 7
	Sewage Treatment System construction	Pre-operations construction
	Hydrometallurgical Residue Facility (HRF) construction	Intermittent, Pre-operations construction and Mine Year 3
	HRF liner (collected precipitation)	Mine Year 4 through 20
	HRF wick drains, if needed	Pre-operations construction to Mine Year 20
	Lined and concrete ponds (WWTS, Sewage Treatment System, Plant Reservoir–collected precipitation)	Mine Year 1 through 20
	Colby Lake pipeline upgrades	Pre-operations construction
	Miscellaneous construction dewatering	Intermittent, as needed
Colby Lake	Colby Lake Pumphouse	Pre-operation construction phase to Mine Year 20

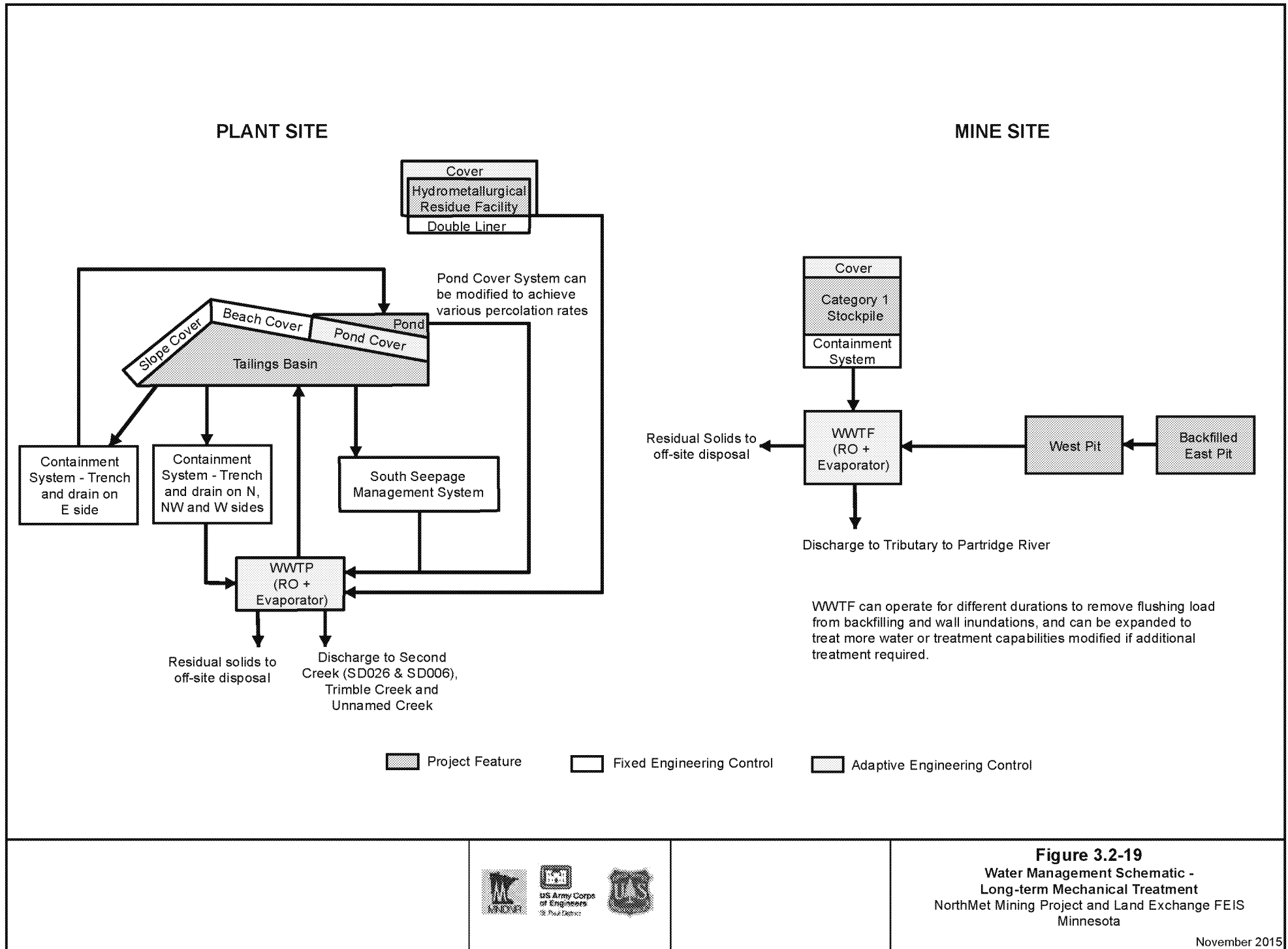


**Figure 3.2-17**  
Water Management Schematic -  
Reclamation - Approximate Years 21-30  
NorthMet Mining Project and Land Exchange FEIS  
Minnesota

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**Figure 3.2-19**  
Water Management Schematic -  
Long-term Mechanical Treatment  
NorthMet Mining Project and Land Exchange FEIS  
Minnesota

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**Review of the NorthMet Mining Project and Land Exchange**  
**Supplemental Environment Impact Statement, November, 2013**

Donald W. Lee, Ph.D., P.E.

March 10, 2014

**Overview**

I am retired from a 31-year career of environmental research at Oak Ridge National Laboratory. My title at the time of retirement was Senior Research Scientist. My technical specialties are fluid mechanics, hydrology, environmental impact assessment and performance assessment applied to waste management facilities. My training is in applied mechanics, engineering science and mechanical engineering. My research areas are in waste management, safety analysis, and environmental impact analysis of major energy projects. I have over 150 publications as environmental impact statements, technical reports, refereed journal publications, and book chapters. I have performed research for the Nuclear Regulatory Commission, Department of Defense, Department of Army, Environmental Protection Agency, Department of Energy, and Federal Energy Regulatory Commission. I served as an expert witness for the U. S. Environmental Protection Agency Region II in the matter of National Discharge Elimination System Permits for Central Hudson Gas & Electric Corp., Roseton Generating Station, et al. in New York, New York. A detailed resume of my experience and training is attached.

I have prepared and reviewed numerous environmental impact statements for nuclear power stations, coal fired power plants, hydropower plants, uranium mining, chemical weapons destruction facilities, and energy conservation technologies. My technical focus for the majority of these activities has focused on the analysis of surface water and groundwater hydrology, and the impacts to surface water and groundwater resources from the proposed actions and their alternatives. I have also prepared mitigation strategies to minimize potential impacts to the environment. I am knowledgeable of the regulations for the National Environmental Policy Act in both their application to projects and the subsequent enforcement of the regulations. My review of this project is based on this experience. The review that follows identifies many of the regulatory and technical weaknesses that are present in the NorthMet Mining Project and Land Exchange Supplemental Environmental Impact Statement (SDEIS).

The SDEIS is not compliant with the regulations in 40 CFR 1500 – 1508, and is technically inadequate. The proposed action is conceptual and not specific, and is not compared to reasonable alternatives. The descriptions of the affected environment are not representative of the site specific conditions at the mine site or the plant site. The environmental consequences presented in the SDEIS are based on assumptions that are not substantiated or are unjustified. Consequently, the conclusions presented in the SDEIS are not defensible and should not be used as a basis for making decisions affecting the environment.

**Failure to Respond to 40 CFR 1500 – 1508**

The SDEIS fails to identify and assess the reasonable alternatives to the proposed action as required by 40 CFR 1500.2(e). Only one alternative is identified, underground mining, but it is dismissed as being not profitable in an analysis using generalized assumptions not representative of the NorthMet site (Appendix B, Attachment 1 of the SDEIS). A similar analysis for the proposed action, which would allow a comparison, is not presented. Alternative sites, waste management, water management, tailings management, monitoring, and mitigation measures are not considered or assessed. The consequences of potential accidents and alternatives for mitigating any potential accidents are not identified or assessed. The SDEIS does consider the alternatives for the exchange of land, but the SDEIS cannot be considered compliant with the regulations in 40 CFR 1500 – 1508 for the consideration of alternatives for the mining project.

“The primary purpose of an environmental impact statement is to serve as an action forcing device to insure that the policies and goals defined in the Act are infused in the ongoing programs and actions of the Federal government.” (40 CFR 1502.1) This purpose has not been realized in the SDEIS. On page ES-42, the claim is made that alternatives were identified and screened in accordance with the requirements of 40 CFR 1505.1(e). This is an erroneous citation. The reference to 40 CFR 1505.1(e) refers to NEPA and agency decisionmaking procedures, not the preparation of an EIS. The correct citation is 40 CFR 1502.14, which states, “Alternatives including the proposed action. This section is the heart of the environmental impact statement. Based in the information and analysis presented in the sections on the Affected Environment (1502.15) and Environmental Consequences (1502.16), it should present the environmental impacts of the proposed action and the alternatives in comparison form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public.” 40 CFR 1502.14 goes on to require a rigorous exploration and objective evaluation of all reasonable alternatives. The SDEIS in Sect. 1.4.1.2 refers to the consideration of “practicable alternatives.” This is simply incorrect. The SDEIS needs to consider all reasonable alternatives. Having not done so is a significant flaw in the SDEIS.

Sect. 3.2.3 provides a discussion of the screening of alternatives to the proposed action. Noteworthy in Sect. 3.2.3, the reference to reasonable alternatives is made in contradiction to Sect. 1.4.1.2. The result of the screening of alternatives in Sect. 3.2.3 was either to eliminate an alternative or incorporate an alternative into the proposed action. As a result, there is no other alternative to the proposed action other than the alternative of no action. This is specious reasoning that is not responsive to the purpose of an environmental impact statement or the requirements of 40 CFR 1502.2(g). Making environmental decisions is not a black or white matter, but is a decision based on making the best choice among the alternatives available to the decisionmaker. The SDEIS preparers have assumed the responsibility of the decisionmaker for each of the Federal agencies responsible for this SDEIS and have made the decision for the decisionmaker prior to receiving public input. This is a clear violation of NEPA and the requirements of 40 CFR 1502.2(g).

The fundamental purpose of the SDEIS is to comply with the requirements of 40 CFR 1500 – 1508. This statement needs to be included in Sect. 1.5 and incorporated into the SDEIS.

40 CFR 1502.7 specifies the page limits for an EIS should be less than 300 pages. 40 CFR 1502.2(a) states “Environmental impact statements should be analytic and not encyclopedic.” 40 CFR 1502.2(c) says that “Environmental impact statements shall be kept concise and shall be no longer than absolutely necessary to comply with NEPA and with these regulations.” The SDEIS is in excess of these page limits, is not concise, and is more encyclopedic than analytic. Redundant information that is often contradictory or irrelevant is included in every section. The history of the SDEIS presented in Sect. 2 is encyclopedic and should be an appendix at best. Sect. 2 does not contribute to the SDEIS or to understanding the information presented in the SDEIS.

40 CFR 1502.23 calls for a cost-benefit analysis when environmentally different alternatives are being considered. While not a requirement for every environmental impact statement, a cost-benefit analysis should be included as an appendix or by reference in evaluating the environmental consequences of the alternatives. The cost-benefit analysis need not display the relative merits and drawbacks of the alternatives in strictly monetary terms when there are important qualitative considerations. This analysis provides no comparison of the proposed action of open pit mining with the alternative of underground mining. The analysis in Appendix B strictly provides an estimate of profit using generalized assumptions applicable to underground mining, which are not site specific. This analysis provides no cost analysis for the proposed action for comparison with the costs of the alternative of underground mining. Furthermore, the consideration of legacy costs for closure, reclamation, monitoring and water treatment are not provided for either underground mining or open pit mining. Sect. 2.4 of Appendix B states, “Economic feasibility is based on the balance of costs and profit margins against the value of mineable material. Since PolyMet is a private sector for profit company, the value of the saleable material would need to provide sufficient income to cover operating cost (which includes but is not limited to the cost of mining, processing, transportation, and waste management), capital cost (to build and sustain facilities), an adequate return to investors, reclamation, and closure costs and taxes.” This is a reasonable statement, but is not supported by the analysis of projected costs and the related benefits for the underground mining alternative. Consequently, the analysis presented in Appendix B is not complete. This analysis does not provide a basis to conclude the underground mining alternative is not profitable, and it is not responsive to the requirements of 40 CFR 1502.23.

Numerous assumptions are incorporated into the description of the affected environment and the environmental consequences. Some of the assumptions are stated as matters of fact, which they are not, while stated assumptions often are not justified. While the proposed action is complex and there are numerous unknowns that would only be quantified if site operations were to begin, 40 CFR 1502.22 provides the necessary requirements for addressing information that is incomplete or not available. In these circumstances, the environmental impact statement should make clear the information that is lacking. The SDEIS has not presented this in Sects. 3, 4, and 5. Furthermore, 40 CFR 1502.22(b) requires statements and analysis to be included in an environmental impact statement when obtaining information is too costly or methods are unknown. Incomplete or unavailable information has been insufficiently addressed in the SDEIS, but is an important factor in understanding the environmental consequences of the proposed action.

### **Failure to Describe the Proposed Action**

The description of the proposed action is conceptual and not quantitative. While the process description in Sect. 3 is largely complete, the fluxes within the process are incomplete or missing. For example, on page 3-163, the makeup water is described as being between 20 – 810 gpm. At the least, this sort of description is confusing and leads to the conclusion the design is incomplete.

A large source of confusion is the categorization of the blasted material in the open pit into ore or one of the four waste rock classifications. Figure 3.2-2 suggests the segregation of materials into one of the five categories is performed in the pit after blasting. How can this possibly be done with the huge amount of rock after each blasting? Table 3.2-8 is not sufficient to justify the categorization of the materials. The segregation of the waste rock into Category 1 is of special importance since this material will be permanently placed in an unlined pile that can leach contaminants directly to the surficial materials and subsequently to bedrock.

The Category 1 waste rock pile is proposed to have a cutoff wall and a drainage collection system around the entire perimeter of the pile. The water collected by the system is to be sent to the WWTF. The collection efficiency of the collection system is alleged to be greater than 90% (pg. 3-46). This is simply an assumption not justified or supported by analysis or data. Such a drainage system would require routine maintenance to prevent clogging from fines or mineralization. This is not noted in Sect. 3 and is not considered in Sect. 5.

Figure 3.2-16 assumes the water table will be below the base of the Category 1 waste rock pile. This assumption is unjustified and unlikely to occur, especially as the pile ages and the performance of the collection system degrades. The performance of the Category 1 waste rock pile depends on the physical and chemical characteristics of the waste rock. These parameters have not been characterized for the Category 1 waste rock or any of the other categories of material, beyond stating their presumed sulfate concentrations. This lack of data regarding physical and chemical characteristics of the waste rock carries over to the design of the WWTF, which could be inadequate for the contaminants in the influent.

The proposed design for the tailings pile (a 200 ft. tall pile is not a basin) includes a cutoff wall and a drainage collection system around the some portions of the pile. The collected water from the drainage system is to be sent to the WWTP. The collection efficiency of this drainage system is assumed to be greater than 99%. This is an assumption that is not justified or supported by analysis. Similar to the Category 1 waste rock pile, there is no recognition of the need for routine maintenance of the system to ensure drains are not clogged with fines or mineralization either in Sect. 3 or Sect. 5.

Figure 3.2-28 of the tailings pile assumes the bedrock beneath the tailings pile is a no flow boundary (impermeable). This is not justified and is an incorrect interpretation of the local geology. On pg. 4-94, the SDEIS considers the geology of the Giants Ridge Granite to be mechanically similar to the Duluth Complex and to have similar hydrogeological characteristics. The Duluth Complex is fractured and faulted as evidenced by the high wall in the Dunka Pit. Accepting the geologic description of Giants Ridge Granite in the SDEIS, a no flow boundary beneath the tailings pile is an unjustified assumption that leads to misleading results in Sect. 5. The flawed assumptions in the tailings pile design lead to errors in

the determination of the environmental impacts. The tailings pile is currently discharging water and contaminants to surface water, surficial deposits, and bedrock. Placing a cutoff wall around some portions of the tailings pile is insufficient to contain all of the water currently discharging to the surficial deposits and bedrock. Water and contaminants from the tailings pile discharging to the surficial deposits is likely to discharge to the Partridge and Embarrass Rivers. Water discharging to the fractured bedrock could discharge to surface water at any location depending on the nature of the fractures in the rock.

The proposed action manages water at the mine and plant sites with only storm water being released to surface water. There is no provision for managing accumulated water within the tailings pile or the material piles at the mine site to drain in the event of excessive rainfall, snowmelt, or excessive discharges from the mine site or the plant site. As a result, the potential for significant consequences from reasonably foreseeable accidental events needs to be considered in the SDEIS as required by 40 CFR 1502.22(b)(4).

A significant weakness of the description of the proposed action is the dependence of the design on assumptions presented in Sect. 5. The determination of fluxes of water and contaminants are important to understand the proposed design, but the fluxes are not provided. As a result, the consistency of the design with the consequence analysis is not established. A water balance for the proposed action has not been provided, and mass balances for various elements of concern are also not available. Lacking these fundamental analysis tools, the reasonableness of the results presented in the SDEIS cannot be assessed.

The alternatives presentation in Sect. 3 is flawed. The preparers of the SDEIS have decided among all of the alternatives which are acceptable and which should be eliminated, rather than allowing the decisionmaker to make the decision after the public comment on the alternatives. As noted earlier, this is a direct violation of 40 CFR 1502.14. Additionally, the alternatives eliminated by the preparers of the SDEIS were not analyzed for their environmental consequences, which preclude any real comparison of alternatives.

### **Failure to Describe the Affected Environment**

The description of the affected environment includes many implied assumptions that lead to misrepresentations of the environment. For example, at the beginning of the section, references are made to pump tests performed in the bedrock. The text and references allow that the bedrock is fractured with faults and joints. Pump tests in fractured rock are difficult to interpret, because the standard model for the interpretation of pump test data assumes a porous media, not a fractured media. Fractured media are very conductive in the fractures but not conductive in the unfractured portion of the media. Consequently, pump test data interpreted as porous media yield an average value that underestimates the transport rate in the fractures. The connectivity of the fractures is also difficult to interpret simply from pump testing. Tracer testing is best used to establish the connectivity of fractures, but there is no indication that tracer testing was performed at the mine site in the Duluth Complex, or in the Giants Ridge Complex at the tailings pile site.

Figures 4.2.2-5 and 4.2.2-6 are identified as estimated contours. The wells used as ground truth for the estimated contours are not incorporated into the figures. Given the resolution presented in these figures, understanding the actual data points is important to understanding the initial conditions of the mine and plant site that form the inputs to the modeling in Sect. 5.0. The implicit assumptions in these figures influence the accuracy of the modeling. Importantly, Figure 4.2.2-6 shows the existing groundwater mounds at the tailings pile. These mounds will only get higher as additional tailings are added to the tailings pile. The text (pg. 4-53) uses the classical aquifer description of the water table being a subdued replica of the topographic surface. This is a reasonable assumption for the surficial deposits, but extending this assumption to the bedrock is unjustified. While the bedrock groundwater is connected to the groundwater in the surficial deposits, the behavior of groundwater in the bedrock is controlled by the structural properties (i.e. fractures, joints, and faults) of the bedrock, not the topographic surface. This erroneous assumption misrepresents the nature of the groundwater

XPSWMM, MODFLOW and GoldSim are models. On pg. 4-60, XPSMM outputs are referred to as predictions. At best, the outputs are simulations. At worst, the outputs are misrepresentations. The outputs most certainly are not predictions. This comment applies to numerous other misuses of the word prediction in Sect. 4 and Sect. 5.

Table 4.2.2-23 clearly illustrates the tailings pile and its associated waters are a significant source of sulfate in water at the present and could remain a long-term source of sulfate contamination if not remediated. The addition of sulfate to the tailings pile from sulfide mining provides little room for additional sulfate without violating water quality criteria and exceeding the wild rice criteria. The average sulfate content in Spring Creek currently exceeds the MN water quality criteria (Table 4.2.2-29). This is a compliance issue being addressed, but the addition of the tailings and contaminated water to the tailings pile from the PolyMet mine and plant sites is likely to increase sulfate discharges from the tailings pile. The SDEIS hypothesis that adding tailings and process water from copper-nickel processing will reduce sulfates and other solutes of concern is unjustified and inherently unreasonable.

The text discusses the hydrology of the mine site and suggests surface water and groundwater in the surficial deposits drain to the south and the Partridge River. However, on pg. 4-149 runoff from the northernmost portion of the mine site is said to drain into the 100-mile swamp. Mining will affect the quantity of runoff available to the ephemeral drainage of the mine site and subsequently affect the hydrology of the 100-mile swamp. This portion of the affected environment has not been quantified and the impacts to the 100-mile swamp have not been analyzed in Sect. 5.

The nature of the interaction of groundwater between the surficial deposits and the bedrock is important to understand in terms of the transport of contaminants. On pg. 4-149, the statement is made "Because of the low permeability of the bedrock, the interaction between the surficial deposits and the bedrock aquifer is assumed to be insignificant, according to Seigel and Ericson (1980) and Barr (2010d)." In this example, the answer is assumed without the benefit of site-specific data or any analysis. No tracer tests have been conducted. Additionally, during modeling in Sect. 5 the interface between the two systems is assumed to be a no-flow boundary. Not too surprisingly, adverse impacts to the bedrock aquifer do not occur. This is an important, but simple, misrepresentation of the affected environment.

The unanswered question in Sect. 4.2.14 is the stability of the existing tailings pile. If the existing tailings pile is not stable, then placing additional tailings on top of the tailings pile leads to potentially serious impacts. Similarly, are the landfilled materials and underlying compressed peat at the HRF stable?

A misrepresentation of note in this section is the presentation of the bedrock aquifer. Figure 3.2-28 identifies bedrock materials as a no flow zone beneath the tailings pile, which means the conductivity is zero. Table 4.2.2-5 makes reference to pump tests performed in the bedrock aquifer of the Duluth Complex that have a mean conductivity of  $2.3 \times 10^{-3}$  feet/day, which is certainly greater than zero. These two formations are supposed to have the same hydrogeological characteristics. There is no explanation for this contradiction. Figure 3.2-16 suggests water flows upward from the bedrock to the seepage collection system. Seepage is driven by gravity and cannot flow upwards. The discussion of the hydrogeology of the bedrock at the mine site and the plant site does not consider the effects of glaciation and glacial rebound, which leads to the development of fractures in the bedrock of both the mine site and the plant site. Importantly, the tailings pile and the Category 1 waste rock pile are significant sources of sulfate contamination and have no liner. These are major sources of contamination that will discharge to bedrock. The direction and flux of this leachate cannot be assumed not to enter bedrock from the tailings pile or to be minimized as discussed on pg. 4-45 at the mine site.

#### **Failure to Justify the Environmental Consequences of the Proposed Action**

The environmental consequences of the proposed open pit mine and the associated plant site are not justified, and the SDEIS misrepresents the reasonable impacts to be expected.

The notion of collection efficiency greater than 90% of seepage from the Category 1 waste rock and greater than 99% from the tailings pile is simply an assumption that cannot be justified (pg. 5-6). The Category 1 waste rock pile and the tailings pile have no liner, which could provide some mitigation for sulfates generated in the piles. But the piles are not lined. Sulfates will be generated from the waste rock and tailings. The contaminants will migrate into the underlying surficial materials and bedrock. Some of the leachate will be collected by the drainage works around the piles for a while (far less than the projected performance period), but some of the contaminants will enter the bedrock, which is fractured. The text in this section is of the opinion that the fracturing is limited. A visual review of the high wall of the Dunka Pit, where all of the formations are visible, illustrates to even the most casual observer, that the Duluth Complex is fully fractured, as is the Virginia formation. This simple observation points out the assumed efficiency of both the unlined Category 1 waste rock pile and the tailings pile collection systems are not representative of the site characteristics. The environmental consequences of the proposed action are misleading and misrepresent the reasonable impacts of the proposed action.

In a similar fashion, the performance period for treatment at the mine site is modeled as 200 years and the performance period for the plant site as 500 years. These periods are again simply assumptions that are not justified. Not only are they not justified, they are unreasonable. There is no evidence that the engineered systems proposed can reasonably be expected to perform as built for 500 years. There is no discussion or analysis to support the long-term performance of the WWTP. There is no analysis of

accidents or failures over these extended performance periods. There is no consideration of alternatives that would not require these extended performance periods. To accept these extended performance periods without the consideration of alternatives is contrary to the requirements of 40 CFR 1500 – 1508 and renders the SDEIS unacceptable.

As mentioned in this review of Sect. 4, models do not provide predictions, especially of the future. Models do provide simulations when they are done well, within the constraints of the model, and the input data available. Lacking sufficient data or incorporating unjustified assumptions leads to misleading and misrepresentative results. This is illustrated graphically in the approach to addressing fractures and fracture flow. In Sect. 3 the figures and text point to the bedrock beneath the Category 1 waste rock and tailings piles as no flow or nearly no flow boundaries. This presumes the contamination generated in the Category 1 waste rock pile and the tailings pile cannot be transported to groundwater in the model. In contrast, in Sect. 4, permeability of the bedrock at the mine site and plant site is determined using pump testing and slug testing. The data developed by these tests are analyzed using models that assume the bedrock is porous media.

In Sect. 5, bedrock impacts are stated. On pg. 5-26, MODFLOW is said to be used as a two layer model with one layer for the surficial materials and one layer for bedrock for the mine site. On pg. 5-27, MODFLOW is said to be used at the mine site with one layer for the surficial materials and seven layers for the bedrock. On pg. 5-33, there is discussion to suggest the presence of fractures in the Duluth Complex could affect transport rates, but the significance of the fractures is not considered to be significant. The discussion states that the Duluth Complex is highly competent with very low conductivities. This is not a justifiable remark. These contradictory discussions are simply unacceptable and at best yield misrepresentations of the proposed action, the affected environment and the environmental consequences of the proposed action.

Figure 5.2.2-4 does not show any groundwater flow to the north from the East Pit. As noted in Sect. 4, there is discharge to the north from the East Pit area to the 100-Mile Swamp. There is no attempt to analyze the impacts to the 100-Mile Swamp from the effects of mining.

The numbers presented in Table 5.2.2-8 show very small recharge fluxes for the East and West Pits. These rates can be no more than assumptions that are not justified. Not only are the materials in the East and West Pits fractured, their fractures are certain to be further enhanced by the blasting associated with open pit mining. The assumed low conductivities result in lowered fluxes of contaminants from the pits with reduced concentrations. The information contained in this Table is misleading.

The conductivities presented in Table 5.2.2-9 appear to be very low. The low conductivities presented will result in low transport rates in the surficial materials and extended periods of time before concentrations of contaminants decline. There is no comparison presented between the MODFLOW results with equivalent monitoring data. Additionally, there is no comparison of the bedrock conductivity with actual data. The proper consideration of fractured materials would lead to a dual porosity model with high conductivities in the fractures and very low conductivities in the unfractured

material. With the consideration of fractures, concentrations of contaminants will be higher and of shorter duration. The slimes that are present in the tailings pile are not included in this table. The results presented here are misrepresentative of the impacts that can reasonably be expected.

Table 5.2.2-9 also presents information for the East and West cells of the tailings piles. The horizontal conductivities differ by a factor of two between the West and East tailings piles and the vertical conductivities differ by a factor of ten. Since the current piles are from the same source, how can there be factors of two and ten difference between the two? This leads to confusion.

Fig. 5.2.2-6 does not incorporate the historical creeks that are present beneath the existing tailings pile. Tailings were simply placed on top of the ground from the previous mining project. Even though the creeks are buried, they are likely to still functioning hydrologically. Failure to consider the existence of these creeks in the MODFLOW and GoldSim models underestimates the leakage from the pile both currently and in the future. No justification is provided for failing to consider future discharge to the south from the tailings pile. The creek associated with the discharge to the south originates beneath the pile. Without major geotechnical work, discharges from the south of the tailings pile will continue into the future. The proposed collection system for Second Creek will collect some but not all of the leakage from the tailings pile. The leakage flux will increase as the height of the tailings pile is increased and as degradation of the collection system occurs over time.

Table 5.2.2-11 presents information for modeling that is difficult to understand. The recharge flux from the tailings pile is 0.765 in/yr as noted in this table. The excess of precipitation over evapotranspiration in St. Louis County, MN is 6 in/yr (MDNR, "Climate's Impact on Water Availability"). This leaves 5.235 in/yr of water that has to go somewhere. If the collection efficiencies actually perform to drain in excess of 99% of the available water in the tailings pile, there are still an extra 0.05 in/yr which would be left to accumulate in the tailings pile. With annual and seasonal fluctuations to be expected, this design is marginal at best. The assumption of 99% collection efficiency is necessary to make the tailings pile operations plausible. No consideration of any alternative operational efficiency is considered. No water budget is presented for this proposed project. The results presented indicate that even a simple water balance raises doubts. Again, this simple observation underscores the misrepresentation of the project presented in this section.

Table 5.2.2-11 also provides an estimate of when contaminated groundwater from the tailings pile would reach groundwater evaluation points or surface water. The estimates range from 343 to 208 years. Contaminated groundwater from the tailings pile is currently being discharged to groundwater and surface water after less than fifty years. The contrast between reality and these precise estimates illustrate the depth of the assumptions of performance incorporated into the analysis. Given the lack of field demonstration of the significant assumptions invoked in this analysis, the obvious conclusion is the results are misleading.

On pg. 5-55 the text says, "However, due to the very low bulk hydraulic conductivity of the bedrock, groundwater flow rates in these flow paths were not large enough to affect water quality at the groundwater and surface water evaluation locations." This statement may be correct for results of this

modeling exercise, but the assumptions put into the model such as a no flow boundary beneath the Category 1 waste rock and tailings piles simply makes this conclusion unwarranted and a misrepresentation of the impacts of the proposed action.

The presentation of results from all of the modeling performed to evaluate impacts is not clear. Meaningful results would include a simple plot of model results that would show the concentration of contaminants over time with special emphasis on sulfates at various locations at the mine site and the plant site. The maximum values determined by the modeling should be presented. While the notion of a concentration cap or solubility limit is chemically feasible, there is no justification for imposing such limits to this analysis. If concentration caps were imposed in this analysis, what are they and to which elements were they applied? Failure to present these assumptions is a failure of this analysis. Utilizing such constructs is not necessarily conservative. To use non-conservative assumptions results in misleading results.

On pg. 5-68 the text reads “Due to the very low hydraulic conductivity of the bedrock, and the slurry trench would be keyed into the bedrock, the GoldSim model assumes the bypass of groundwater via bedrock is negligible compared to that occurring in the surficial unit.” This is nonsense. GoldSim by itself cannot assume anything. The analysis assumes that contaminant flow in fractures can be ignored, without any data to support the assumption. Consequently, this is another example of the analysis misrepresenting the proposed action.

On pg. 5-78 another description of the water management system is presented. This description includes many subtle refinements not present in Sect. 3. This section suggests that the design for the plant is either evolving or incompletely disclosed. More assumptions are introduced that are associated with the anticipated performance of the WWTF and the WWTP. However, this lengthy description fails to provide a simple water budget.

The water management system description seems to show that there is sufficient water to operate the mine and processing facility using the collected and appropriated water resources. However, once the mine is closed, there is too much water for plant operations; thus, the design of the facilities becomes a significant issue. The text assumes the WWTP with reverse osmosis has the capacity to address the excess water from the plant site, but no design parameters are provided. This lack of analysis renders the presentation incomplete.

The description of what happens after mine operations cease is simply a narrative and not an analysis. There is no basis to conclude what the environmental consequences would be following the end of operations. The narrative is merely a projection of desired outcomes.

Fig. 5.2.2-18 presents a GoldSim result that has a maximum concentration of sulfate at 2500 mg/L, which precipitously drops to approximately 250 mg/L by year 35. The SDEIS does not explain the constant sulfate concentrations for 20 years, the order of magnitude reduction in the sulfate concentration over 15 years, or the constant sulfate concentration for the next 165 years. These abrupt changes in sulfate concentrations are not the result of some physical or chemical changes, but are the result of unsubstantiated assumptions with respect to treatment plant performance and subaqueous

disposal that are built into the model. These implicit assumptions must be explicitly disclosed and substantiated, since they are the likely basis for this improbable set of results.

The bullet list on pg. 5-105 of variables that influence groundwater transport should make important modeling assumptions apparent. The bullets should include, “the assumptions in the model that characterize the bedrock as impermeable and that no advection of contaminants occurs from the West and East pits.” Also another bullet should be added that states, “The WWTF is assumed to operate as built for at least 100 years without any degradation.” Failing to include these assumptions is a misrepresentation of the proposed action.

Table 5.2.2-22 lists potential contaminant sources, but either does not consider any releases from the west equalization basins at the WWTF, or allows for arbitrarily low leakage rates. Assuming no releases or minimal releases from the WWTF is an implicit assumption that is not justified. The WWTF West Equalization basins will contain reject concentrate with extremely high sulfate concentrations. The liner systems for these basins are assumed to either not leak or have minimal leakage during operations. This is unrealistic, especially for the long periods of time assumed for WWTF operations. The impacts to the environment from the construction and operation of the WWTF are not addressed in the analysis. In addition, any accidents at the WWTF that would result in significant impacts to the environment are not addressed. Lacking a detailed consideration of the potential impacts from the WWTF is a significant weakness of the analysis and leads to unwarranted conclusions of the proposed action and any potential alternatives.

On Pg. 5-121 the capture of seepage from the south side of the tailings pile and the flow augmentation of Second Creek is described. For this description to be valid the existing pumping system for capturing seepage to Second Creek would have to be assumed to operate perfectly. The WWTP would have to operate without accidental disruption for hundreds of years, the pumping system would also have to work without failure for hundreds of years, the addition of approximately 100 ft. of saturated tailings to the tailings pile could not significantly increase the leakage from the tailings pile, and the natural drainage of Second Creek which originates under the tailings pile could not discharge beneath or around the collection system. This set of implicit assumptions have not been disclosed or justified in the analysis.

Table 5.2.2-26 identifies the WWTF as a source term for mine years 0 – 35. However, the WWTF is intended to operate for hundreds of years. The WWTF will remain a source term throughout operations and long after the termination of operations as a result of the legacy of leakage from the equalization basins, even if reject concentrate is no longer transported from the plant site. This table contributes to misleading results as evidenced by Table 5.2.2-22.

Table 5.2.2-29 suggests that background groundwater, non-contact stormwater and the Northshore Mine operations contribute to the sulfate loading in the Partridge River at SW-004a. The table also suggests that no PolyMet sources contribute to the sulfate loading except a 4.3% increase resulting from water treated at the WWTF in closure year 200. To reach this conclusion, implicit assumptions that are

not conservative must have been built into the GoldSim model. These implicit assumptions need to be identified since they are the likely basis for this improbable set of results.

On pg. 5-128 the water quality at SW-001 is eliminated from consideration by assumption. However, drainage from the East Pit area currently discharges to the North near SW-001. Again the assumptions incorporated into the analysis have defined the result without the benefit of any analysis. The results are simply unjustified.

Fig. 5.2.2-27 is physically unrealistic. For this result to have any basis in reality, a continuous, constant source term would have to be associated with the model. Except for a natural source, such a source term does not exist, and will not exist as a result of this project. The nature of the open pit mine will lead to a significant increase in sulfates from releases from the mine plant areas to the surrounding environment that will decline over time. This figure and the subsequent figures which show constant concentrations of sulfate over hundreds of years are misleading and unjustified. Instead of invoking unrealistic and unsubstantiated assumptions, an attempt to provide a realistic set of results is needed.

Table 5.2.2-36 is yet another example of the use of implicit assumptions to provide a result which is misleading. The notion that the addition of 100 ft. of saturated tailings to the tailings pile will not affect groundwater seepage is physically unrealistic. The notion of partial containment structures around the tailings pile collecting nearly all of the drainage from the tailings pile that has no liner is also unrealistic. These results are simply misleading.

On pg. 5-210 the concept of an Adaptive Water Management Plan is introduced. The fact that a plan to mitigate impacts is deemed necessary in spite of the multitude of modeling previously claimed to show no significant impacts to water quantity or water quality, suggests a lack of confidence in the model results. Mitigation measures described on pg. 5-213 to 5-216 are described as contingency measures, but not analyzed as mitigation measures for the project. The long list of modifications to the water management design since the DEIS is described on pg. 5-210 to 5-211 suggests that any other mitigation alternatives have been rejected from consideration or analysis. Taken together, these discussions preclude the consideration of any mitigation alternatives to the proposed action; this notion is contrary to 40 CFR 1502.14.

On pg. 5-227 the discussion suggests that MODFLOW cannot be used to determine the effects of pit dewatering on wetlands. While an analog approach may give a reasonable basis for evaluating wetlands, such an analog approach would have to be validated, and no such validation is provided in the SDEIS. Actually, MODFLOW has the capability to calculate the effects of pit dewatering providing the appropriate input is incorporated into the model. At this stage of the SDEIS, where MODFLOW has already been used extensively to evaluate the consequences of the proposed action, suggesting MODFLOW cannot be used for wetlands assessment discredits all of the preceding analysis of hydrology and water quality. Suggesting MODFLOW cannot be used because of the nature of the surficial deposits is to say MODFLOW has not been appropriate to evaluate all of the preceding impacts of the proposed action contained in the SDEIS. This internal contradiction is sufficient to reject the analysis of hydrology and water quality in the SDEIS as inadequate.

In the discussion of wetlands in Sect. 5.2.3, effects of developing the East Pit, potential alteration of the current discharge to the North of the mine site, and the impacts to the 100-mile Swamp are not presented. Given the current drainage to the 100-mile Swamp and the significance of this resource, the impacts to this particular wetlands area need to be addressed in the SDEIS.

### **Summary**

This review of the NorthMet Mining Project and Land Exchange Supplemental Environmental Impact Statement has focused on the adequacy of the SDEIS with respect to the regulations in 40 CFR 1500 – 1508 and the adequacy of the analyses presented in the SDEIS. The SDEIS is not responsive to the regulations as noted in this review, and should be rejected solely on the basis of the lack of regulatory compliance. The analyses presented in the SDEIS are not based on an analytical or scientific review of the proposed action and the reasonable alternatives to the proposed action. Instead, the analyses are based on a conceptual description of the proposed action and an extensive set of assumptions of the environment and the performance of the conceptual design. The SDEIS is technically inadequate as a result of the numerous omissions and flaws in the analyses presented in the SDEIS. In my experience of reviewing and preparing environmental impact statements, the SDEIS is the least defensible and most technically flawed environmental impact statement I have encountered.

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Member, DOE Defense Nuclear Facilities Safety Board Recommendation 94-2, Site Assessment  
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Member, DOE Defense Nuclear Facilities Safety Board Recommendation 94-2. Working Group  
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Member, American Society of Civil Engineers Task Committee on Mixed Waste, 1988 – 1993

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“Y-12 Dispersion Analysis Training Workshop,” Y-12 Plant, September 20 – 21, 2001 (with R. L. Miller and A. L. Sjoreen)

“Evaluation of Hazardous Materials Management Practices for Application to Range Residue Management,” 29<sup>th</sup> Biannual Meeting of the Department of Defense Explosives Safety Board, New Orleans, Louisiana, July 14, 2000 (invited)

“Composite Analysis of Oak Ridge Disposal Sites,” as part of Management of Disposal of Radioactive Waste by Dade Moeller & Associates for DOE-ORO, December 10, 1998

“Legal Disposition before Randy McDowell, Attorney, Commonwealth of Kentucky, Paducah, Kentucky on the matter of the Commonwealth of Kentucky vs. U. S. DOE,” Paducah, Kentucky, June 4, 1998

“Savannah River Site Composite Analysis Training,” DOE SRO, March 12, 1998

“Solid Waste Storage Area 6 – Performance Assessment and Composite Analysis – Implications to CERCLA and Land Use Planning,” DOE-ORO, March 6, 1998

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“Oak Ridge Reservation Composite Analysis Overview,” DOE Composite Analysis Workshop, Gaithersburg, Maryland, August 20, 1996

“Progress Toward the Implementation of the Operating Limit for the PGDP Landfill,” Paducah, Kentucky, June 11, 1996

“Performance Assessment of Low-Level Radioactive Waste Disposal Facilities – Oak Ridge Perspective,” Scientific Delegation from the United Kingdom, DOE – ORO, April 2, 1996

“Performance Assessment for All Sources for the Oak Ridge Reservation,” DOE All Sources Workshop, Gaithersburg, Maryland, January, 30 1996

“Operating Limit Evaluation for Disposal of Uranium Enrichment Plant Wastes,” 29<sup>th</sup> Midyear Meeting of the Health Physics Society, Scottsdale Arizona, January 9, 1996

“Implementation of the Operating Limit for the New Solid Waste Landfill,” DOE Paducah Field Office, Paducah, Kentucky, December 6, 1995

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“Operating Limit Study for the Proposed Solid Waste Landfill at Paducah Gaseous Diffusion Plant,” Commonwealth of Kentucky, Frankfurt, Kentucky, February 2, 1995.

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“Performance Assessment Experience at Oak Ridge National Laboratory,” 16<sup>th</sup> Annual U. S. Department of Energy Low-Level Radioactive Waste Management Conference, Phoenix, Arizona, December 13, 1994

“Industrial Landfill Study – Radionuclide Operating Limits – Results,” Paducah Gaseous Diffusion Plant, Paducah, Kentucky, September 19, 1994

“Uncertainty Analysis for Low-Level Radioactive Waste Disposal Performance Assessment at Oak Ridge National Laboratory,” Spectrum ’94, Atlanta, Georgia, August 17, 1994

“Environmental Transport,” FFCA Disposal Evaluation Workshop, Clearwater, Florida, August 10, 1994

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“Performance Assessment for Continuing and Future Operations at Solid Waste Storage Area 6,” State of Tennessee, Tennessee Department of Environment and Conservation, Oak Ridge, Tennessee, March 7, 1994

“Evaluation of Disposal Site Capabilities on the Oak Ridge Reservation,” National Governor’s Association, Tucson, Arizona, March 3, 1994

“Scoping Calculations for Estimating Disposal Site Capabilities,” DOE – FFCA Disposal Work Group, Dallas, Texas, February 17, 1994

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"SWSA 6 Performance Assessment Status," DOE Low-Level Waste Management Program Steering Committee, Oak Ridge, Tennessee, February 2, 1993

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"Program Highlights, Facility Safety/Waste Management Chapter," GDP/SAR Upgrade Program Review, Oak Ridge, Tennessee, May 7, 1992

"Performance Assessment of Low Level Radioactive Waste Disposal at Oak Ridge National Laboratory," Waste Management '92, Tucson, Arizona, March 3, 1992

"Groundwater Phenomena and the Theory of Mixtures," Applied Mechanics Conference, American Society of Mechanical Engineers, The Ohio State University, Columbus, Ohio, June 1991

"Interpretation of Results of SWSA 6 Performance Assessment," DOE Peer Review Panel, Oak Ridge, Tennessee, March 1991

"Use of Pathways Analysis as a Tool for Effective and Safe Waste Management," American Chemical Society, 200<sup>th</sup> National Meeting, Washington, D. C., August 1990

"Applied Exposure Modeling for Residual Radioactivity and Release Criteria," EPA Workshop on Residual Radioactivity and Release Criteria, St. Michaels, Maryland, September 1989

"Performance Assessment for Future Low-Level Waste Disposal Facilities at ORNL," 11<sup>th</sup> Annual DOE Low-Level Waste Management Conference, Pittsburgh, PA, August, 1989

"Workshop on Pathways Analysis," State of Tennessee, Department of Health and Environment, Nashville, TN, June 1989

"Classification of Groundwaters at Portsmouth Ohio," DOE Steering Group for 40 CFR 193, Washington, D. C., January 1989

“Performance Based Model for Portsmouth Facility,” Workshop on the Management of Contaminated Soils, Knoxville, Tennessee, November, 1988

“DOE Model Strategy for BRC Uranium Wastes,” DOE Model Conference, Oak Ridge, Tennessee, October 1988

“Low-Level Radioactive Waste Disposal in a Humid Environment: A Site Specific Approach with Generic Application,” Joint CSCE/ASCE National Conference on Environmental Engineering, Vancouver, Canada, July, 1988

“The Role of the Intruder in the Management of Low-Level Radioactive Waste,” Oak Ridge Waste Management Advisory Committee, Oak Ridge, Tennessee, June, 1988

“LLWDDD Strategy for BRC Uranium Wastes,” Workshop on the Management of Uranium Bearing Wastes, Oak Ridge Associated Universities, Oak Ridge, Tennessee, May, 1988

“Evaluation of Uranium Leaching from Solid Wastes, Solid Waste Forms: Characteristics and Evaluations,” Workshop on Waste Forms, Oak Ridge National Laboratory, April, 1988 (with R. B. Clapp, J. E. Cline)

“Impact of Below Regulatory Concern on LLWDDD Strategy,” Oak Ridge Waste Management Advisory Committee, Chattanooga, Tennessee, March 1988

“Below Regulatory Concern Pathways Analysis,” Oak Ridge Waste Management Advisory Committee, Chattanooga, Tennessee, March, 1988

“Review of LLWDDD Program Waste Management Strategy,” Ad-Hoc Industry Waste Management Advisory Committee, Oak Ridge, Tennessee, October, 1987

“Low-Level Radioactive Waste Disposal Strategy for the Oak Ridge Reservation,” Southeastern Compact States Association, Oak Ridge, Tennessee, April, 1987

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“An Analysis of Groundwater Contamination of a 6-GeV Continuous Electron Beam Accelerator,” Twentieth Midyear Topical Symposium of the Health Physics Society, Reno, Nevada, February, 1987

"Hydrodynamics of Leaky Groundwater Systems with Partially Penetrating Wells," Energy Division Annual Information Meeting, Oak Ridge National Laboratory, August, 1986 (with J. M. Bownds)

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"An Analytical Model for a Round Buoyant Jet," Joint ASME/ASCE Conference on Mechanics, Boulder, Colorado, June, 1981

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**Table 5-3 Estimated Pumping Summary: by Individual Permit**

Individual Permit	Maximum Daily Rate <sup>(1)</sup> (gpm)	Maximum Monthly Rate <sup>(1)(2)</sup> (gpm)	Maximum Annual Rate <sup>(1)(3)</sup> (gpm)	Maximum Annual Volume <sup>(4)</sup> (MG)	Average Annual Rate <sup>(5)</sup> (gpm)
East Pit	2,340 <sup>(6)</sup>	1,900	1,900	1,000	200 – 800
Central Pit	1,300 <sup>(6)</sup>	1,300	1,300	700	50 – 250
West Pit	2,640 <sup>(6)</sup>	1,500	1,500	800	150 – 550
Mine Site Infrastructure <sup>(7)</sup>	20,250 <sup>(8)</sup>	2,250	2,250	1,200	50 – 500
Plant Site Infrastructure <sup>(7)</sup>	3,750 <sup>(9)</sup>	1,300	1,300	675	250 – 300
Colby Lake	3,400 <sup>(10)</sup>	3,400 <sup>(11)</sup>	3,400	1,800	550-2,000

- (1) Maximum daily, monthly, and annual pumping rates for the Individual Permits occur in different time periods. Rates cannot be summed.
- (2) Highest monthly value of all installations included in permit have been combined: P90 for pit dewatering, operation of the Category 1 Stockpile Groundwater Containment System, precipitation collected in lined features; runoff collected from compacted features, and Colby Lake needs; engineering estimate for other installations with uncertainty factors applied, and rounded up to the nearest 50 gpm.
- (3) To be conservative, maximum annual rate is set equal to maximum monthly rate.
- (4) Maximum annual volume is calculated from the maximum annual rate, rounded up to the nearest 25 MG.
- (5) Range of the average monthly P50 values, on an annual basis, over the years of the appropriation, plus any appropriations associated with scheduled overburden stripping, rounded up to the nearest 50 gpm. This information is provided for context.
- (6) Maximum daily rate based on the design pump capacity.
- (7) See Appendix C for details on the installations that contribute to the maximum rate, the uncertainty factors applied to the flow from each installation, and the rounding that was applied.
- (8) Maximum daily rate is driven by design pump capacities, but also includes short-term construction dewatering that lasts less than one month. To be conservative, all short-term dewatering installations scheduled for a given month are assumed to occur concurrently.
- (9) Maximum daily rate is driven by short-term construction dewatering that lasts less than one month. To be conservative, all short-term dewatering installations scheduled for a given month are assumed to occur concurrently.
- (10) Maximum daily rate set equal to maximum monthly rate, because rate was estimated in GoldSim on a monthly basis.
- (11) Maximum monthly rate includes P90 Goldsim estimate of primary make-up water demands, and engineering estimates of other make-up water demands, See Table 5-6 for details. .

**Table 6-1 Dewatering Discharge Destination, by Installation**

Individual Permit	Installation	Dewatering Discharge Destination <sup>(1)</sup>
East Pit	Overburden stripping	Flotation Tailings Basin (FTB)
	East Pit Sump	FTB
Central Pit	Overburden stripping	FTB
	Central Pit Sump	FTB
West Pit	Overburden stripping	FTB
	West Pit Sump 1 and Sump 2	FTB
Mine Site Infrastructure	Ore Surge Pile foundation, sumps, and overflow ponds construction	FTB
	Construction of new buildings	FTB or off-site through the stormwater management system (to Partridge River tributaries)
	Mine water pond construction	FTB or off-site through the stormwater management system (to Partridge River tributaries)
	Stormwater pond construction	FTB or off-site through the stormwater management system (to Partridge River tributaries)
	Category 4 Waste Rock Stockpile foundation, sumps, and overflow ponds construction	FTB
	Category 2/3 Waste Rock Stockpile foundation, sumps, and overflow ponds construction	FTB
	Category 1 Waste Rock Stockpile foundation construction	FTB
	Category 1 Stockpile Groundwater Containment System construction	FTB
	Category 1 Stockpile Groundwater Containment System operation	FTB
	Category 2/3 Waste Rock Stockpile underdrains, if needed	FTB or East Pit during pit flooding
	Category 4 Waste Rock Stockpile underdrains, if needed	FTB or East Pit during pit flooding
	Ore Surge Pile underdrains, if needed	FTB or East Pit during pit flooding
	Miscellaneous construction dewatering	FTB or off-site through the stormwater management system (to Partridge River tributaries)